CADUCEUS

A Humanities Journal for Medicine and the Health Sciences

150 Years of Collecting Medical History at the Smithsonian Institution

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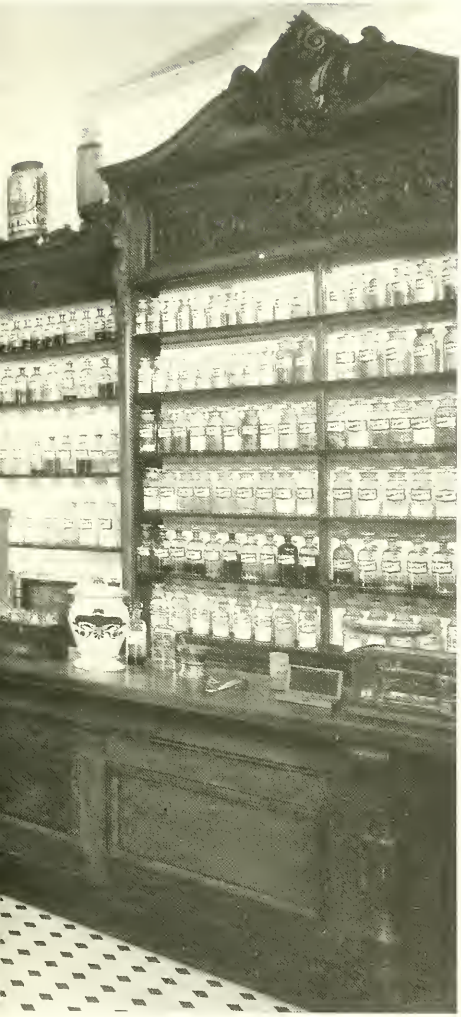
The interior of The 1890's American Drug Store, *featuring the elegant wood and stained-glass Victorian-era fixtures from the Roche Drug Company of Washington, D.C.*



Introduction

150 Years of Collecting Medical History at the Smithsonian Institution

Ramunas Kondratas, *Guest Editor*

In 1996, the Smithsonian Institution celebrated its 150th anniversary. Founded with funds provided by the bequest of James Smithson (1765–1829), the illegitimate son of Hugh Smithson, the Duke of Northumberland, and Elizabeth Keate Macie, a noblewoman and direct descendant of Henry VII, the Institution—with its sixteen museums, archives, libraries, research institutes, and the National Zoo—is the largest museum complex in the world.[1]

Smithson attended Pembroke College at Oxford University (1782–1786), where he studied chemistry and mineralogy. A serious student, he became a gentleman-scientist, much like Thomas Jefferson, and worked for a time in the laboratory of Henry Cavendish, the discoverer of hydrogen. At the young age of twenty-two, he was elected a member of the Royal Society in London. His greatest contribution to science was the discovery and

analysis of a zinc ore that now bears his name, smithsonite.

His illegitimacy, despite his fortune and scientific reputation, precluded him from assuming noble status in England. Perhaps his deeply felt resentment over that exclusion and the urge to perpetuate his name were in part responsible for his decision to write a will that would eventually leave his estate, worth about half-a-million dollars then and about seven million in today's terms, to the United States, a country he never saw. In his will, Smithson left his estate to a nephew, Henry James Hungerford. If Hungerford died childless, however, the entirety of the estate was to go to the United States "to found at Washington, under the name of the Smithsonian Institution, an Establishment for the increase and diffusion of knowledge among men."[2] That was all of the instructions or explanation Smithson gave!

Smithson died in 1829. His nephew died without heirs in 1835, and Smithson's bequest was announced to Congress shortly thereafter. Over the next decade, senators and representatives debated whether to accept the bequest and for what the money should be used. Some envisioned a national university or an agricultural institute. Others wanted to establish a national library or an astronomical observatory. One idea shared by many was the establishment of a national museum. Finally, on August 10, 1846, the Twenty-Ninth Congress passed the bill of incorporation for the Smithsonian Institution, which contained few specific provisions except those for a home for the "natural history collections, a chemical laboratory, a library, a gallery of art, and the necessary lecture-rooms."[3] These were the seeds from which the current institution grew.

The Board of Regents—composed of the Vice-President, the Chief Justice, three senators, three House members, the mayor of the District of Columbia, and six citizens at large—elected Joseph Henry, a physicist from Princeton University, the first secretary of the Smithsonian Institution. The young architect James Renwick Jr., who later designed St. Patrick's Cathedral in New York, received the commission for the first building, the red sandstone, Norman-style "Castle" that now serves as the Smithsonian administrative headquarters.

Henry was primarily interested in promoting American science, and thus he devoted most of his energies to the "increase" of knowledge by emphasizing scientific research. His legacy lives on in the scientific work currently being conducted throughout the various research institutes of the Smithsonian, including the National Museum of Natural History, the Smithsonian Astrophysical Observatory, the Center for Earth and Planetary Studies of the National Air and Space Museum, the National Zoological Park, the Smithsonian Environmental Research Center, the Smithsonian Center for Materials Research and Education, and the Smithsonian Tropical Research Institute.

Henry also recruited staff with interest in the sciences and education. One of his most fortunate choices was Spencer Fullerton Baird, who joined the Smithsonian in 1850 as assistant secretary. A naturalist and an avid collector, Baird was more dedicated to the "diffusion" of knowledge, and he directed his efforts to educating the public through displays of collected materials. Moreover, he recruited hundreds of volunteers who acted as associates and agents for the Smithsonian's small permanent staff of curators and

clerks. Through such networks, artifacts and specimens flowed in to the Smithsonian, mostly from western explorations, and the natural history specimen collection quickly grew to about 150,000 items.

In 1857 the Smithsonian received the government collections that were held in the Patent Office Building. Those, together with the thousands of specimens brought to Washington by Baird, formed the early core of the Smithsonian collections. The United States National Museum, administered by the Smithsonian Institution and funded separately by Congress through the Department of the Interior, was created in 1858.

Smithsonian Forebears

The idea for a national museum, of course, predates Baird. Other countries had national museums. The first public museum of natural science and art in the United States was Peale's Museum, founded in Philadelphia in 1785 by Charles Willson Peale. Other public museums were established in the early nineteenth century in Baltimore, Boston, Cincinnati, and New York. But there was no "official" museum for the United States. Natural history objects acquired by the government—many collected by such western explorers as Lewis and Clark—were sent to Peale's Museum, the American Philosophical Society (also in Philadelphia), or the Patent Office Building in the Capital.

When the Smithsonian was in its infancy, there was even another institution in Washington vying for the title of "national museum." The Columbian Institute for the Promotion of Arts and Sciences, privately established in 1816 as the Metropolitan Society but chartered by Congress two years later under the new name, had as its purpose "to collect and examine the various mineral productions and natural curiosities of the United States."[4] Members of that first learned society set up a cabinet of minerals and a museum of "miscellaneous articles." After years of decline, the members reorganized in the 1840s as the National Institution for the Promotion of Science and the Useful Arts, later renamed the National Institute.

Under the leadership of Joel Poinsett, who as an amateur naturalist (after whom the poinsettia was named) as well as the Secretary of War under President Martin Van Buren, the National Institute helped organize the Charles Wilkes expedition to the South Seas (1838–1842), the first feder-

Curators of the Division of Medical Sciences

1881–1884	Dr. James H. Flint
1884–1887	Dr. Henry Gustav Beyer
1887–1891	Dr. James H. Flint
Nov. 1891–April 6, 1892	Dr. John C. Boyd, USN
April, 1892–Jan. 5, 1893	William C. Dixon, USN
Jan. 1893–July 15, 1893	Dr. C. H. White, USN
July, 1893–Jan. 22, 1894	Dr. C. U. Gravatt
Jan. 1894–June 15, 1894	Dr. R. A. Marmion
June 1894–May 24, 1895	Medical Inspector Daniel McMurtrie
May 1895–1912	Dr. James H. Flint
Feb. 1913–Aug. 16, 1917	----------
Aug. 1917–Feb. 1, 1918	Mr. Joseph Donne
April 2, 1918–1948	Dr. Charles Whitebread
1948–1952	George S. Thomas
1952–1959	George B. Griffenhagen
1957–1961	Dr. John Blake
1961–1975	Dr. Sami K. Hamarneh
1967–1994	Dr. Audrey B. Davis
1977–Present	Dr. Ramunas Kondratas
1983–1991	Dr. Barbara Melosh

ally-sponsored maritime exploration, and requested funds to create a museum of natural history to accommodate the specimens from the expedition. The Wilkes collection included ten thousand species of plants, five hundred of birds, and more than five hundred of fishes. Even James Smithson's own cabinet of minerals was entrusted by the government to the National Institute.

The National Institute was divided into several sections, including the Section on Physiology and Medicine, which was attended by local physicians and others interested in medical and scientific research.[5] It was thus one of the early medical associations in Washington. (The first was the Medical Society of the District of Columbia, which was founded in 1817 on the model of the Medical and Chirurgical Faculty of Maryland begun in 1798 and chartered by President James Monroe in 1819.) The National Institute was dissolved in 1861, and its collections turned over to the Smithsonian.

Beginning of the Medical Collections

Natural history was the primary collecting interest of the Smithsonian in the early years. But there was a growing interest in the medical sciences, as well. In 1873, Joseph M. Toner, a leading Washington physician, bibliophile, and philanthropist, provided funds to the Smithsonian for what he called the Toner Lectures, the purpose of which was to advance medical science. Perhaps Toner was inspired by the lectures sponsored by the old Section on Physiology and Medicine at the former National Institute. Only ten Toner Lectures were given from 1873 to 1890.

The biggest boost to the Smithsonian holdings came after the closing of the extravagant 1876 Centennial Exhibition in Philadelphia and the transfer of numerous exhibits, local and foreign, to the United States National Museum. Several dozen freightcars were necessary to transport the objects to Washington. Most could not fit into the Castle building and had to be stored off-site. Among the objects were about six hundred crude drug specimens, which had been specifically collected by the Chinese Imperial Customs Commission for the Centennial Exhibition. These specimens marked the beginning of the medical collection at the Smithsonian. They became part of a new and very active Section of Materia Medica, begun in 1881 in the Department of Anthropology.

The impressive collections from the Centennial Exhibition prompted Congress to authorize a new Arts and Industries Building to house the U.S. National Museum. At Henry's death in 1878, Baird was named secretary and thereafter oversaw construction of the facility. It was first used on March 4, 1881, for the inaugural ball of President James Garfield.

The Section of Materia Medica was sponsored and supervised by the U.S. Navy in cooperation with the Smithsonian. The first curators were Navy doctors interested in pharmacology and pharmacognosy; their assistants, or clerks, were Smithsonian employees. James M. Flint (1838–1919), an Assistant Surgeon of the U.S. Navy and later a Rear Admiral, was the first curator of the medical collections; his work and interests set the tone for the next twenty-five years. His emphasis was first on sorting, examining, identifying, and classifying the various plants, minerals, and animal parts that were used in preparing medicines. Eventually, that information was made available to the medical profession and the public through museum displays. It was just as important

Among the many displays of crude drugs in the Arts and Industries Building at the turn of the twentieth century was this one on cinchona, which is the source of quinine for the treatment of malaria. The exhibit label reads: "This case is arranged to demonstrate the numerous medicinal substances obtained from one member of the vegetable kingdom. The bark of the Cinchona tree contributes the alkaloids and alkaloidal salts shown, which are administered as such or as the ingredients of pharmaceutical preparations."

then, as it is now, to educate the public about how and of what medicines are made.

A visitor to the Museum in 1897 left this description of the displays of crude drugs:

> Specimens of medical forms and crude drugs in all varieties, commercial and botanical, represent the article as samples found in the markets, and these are supplemented by rare samples having notable peculiarities. Each specimen has its label giving special and condensed information, such as scientific and vernacular name, source, commercial variety, and other brief facts, and each group of specimens, arranged under one head, has a similar descriptive card. A colored plate of the plant from which it is derived is displayed with each crude drug, also a pressed and dried specimen of the flowering plant. Sections and magnified drawings, with a view to assist in identification and show physical characters, add to the completeness and accuracy of the exhibits; while official drugs and preparations and those not official nor found in any pharmacopeia,

but which are or have been used as medicaments, help to complete the display.[6]

Largely due to Flint's efforts, the Smithsonian's collection of crude drugs, which eventually grew to about fifteen thousand specimens, was among the best in the world.

Flint realized that crude drugs were just a part of the larger field of medicine—or the "healing arts"—and that it was both proper and necessary to collect and display other "materials and methods used for the prevention and cure of disease."[7] The scope of collecting was thus enlarged to include materials relating to folk medicine, faith cures, ancient medicine, preventive medicine or public health, and physical medicine (including baths, exercise, electricity, massage, bloodletting, and surgery). The name of the Section of Materia Medica was changed to the Division of Medicine in 1898 to reflect the broader scope.

Flint's approach to collecting and display, although more historical, was still very anthropological, in keeping with the tenor of the rest of the museum and the academic world at that time. Exhibits were added on folk medicine, Egyptian and Hebrew medicine, Greco-Roman medicine, psychic medicine, and other related topics.

The Division did not collect anatomical and pathological specimens, however. Such items were under the purview of the Army Medical Museum, also in Washington, which was established in 1862 to collect specimens of morbid anatomy and pathology from the battlefields of the Civil War.[8]

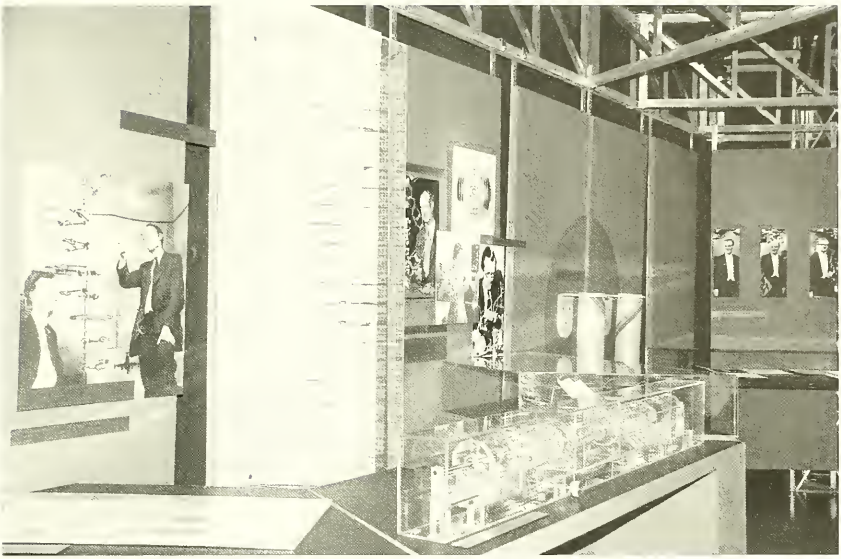
Growing Importance of Pharmacy and Public Health Collections

Flint's commitment to pharmacy was upheld by his successor, Charles Whitebread (1877–1963), a veteran Smithsonian curator who earned a doctoral degree in pharmacy from the George Washington University School of Pharmacy in 1911, when he became curator in 1918. Over Whitebread's thirty-year administration of the Division, he vigorously expanded holdings in the history of pharmacy, alternative medicine (especially homeopathy and osteopathy), and public health. The pharmacy collections grew beyond crude drugs to include the equipment used in their manufacture and sale. One of his most outstanding acquisitions was the exceedingly large and rich E. R. Squibb & Sons Collection of European pharmaceutical artifacts (see sidebar, page 37).

The need to educate the public about such pressing health concerns as pure water and milk, proper waste disposal, disease transmission by insects and animals, oral hygiene, and prenatal and postnatal care led to the opening of the Hall of Health (or Public Health Gallery) in 1924. That expanded interest in public health education, in keeping with the broader national movement for the New Public Health, resulted in another name change for the Division in 1939: the Division of Medicine and Public Health.

Whitebread's successors kept the collecting scope of the Division broad, covering most of the major areas of the health sciences as they developed or emerged. There were some differences in emphasis depending on the particular interests of the curators, but the most marked differences appeared in the interpretation and presentation of the collections.

Curators George S. Thomas (1948–1952), George Griffenhagen (1952–1959), Sami Khalaf Hamarneh (1961–1975), and Museum Specialist Michael Harris



The Search for Life: Genetic Technologies in the 20th Century *exhibition (1987) explored the DNA revolution launched by James Watson and Francis Crick. At center are several brass base pair templates used in their original DNA model. On the left, is a photograph of Watson and Crick with their model and, on the right, photographs of other key contributors to the story of the double helix, such as Rosalind Franklin and Maurice Wilkins.*

(1970–1996) all were trained pharmacists and historians of pharmacy. They made sure that the most salient developments in the history of pharmacy, including its material legacy, were collected and documented. As a result, the Smithsonian pharmacy collections are unequalled in the hemisphere.

John Blake was the first trained historian of medicine to become a division curator. He joined Griffenhagen in 1957 and helped to conceptualize and plan major medical history displays. The U.S. National Museum was reorganized in that year into two parts: the Natural History Museum and the Museum of History and Technology. The Division title changed from the Division of Medicine and Public Health to the Division of Medical Sciences. Planning began for a new Museum of History and Technology. In 1964 the medical collections were moved out of the Arts and Industries Building into the new building, where many were showcased in the Hall of Medical Sciences. The building was designated the National Museum of History and Technology in 1969.

The presentation of objects in the Hall of Medical Sciences, which was divided into large sections on health, medicine, dentistry, and pharmacy, was in sharp contrast to the primarily linear and two-

The showcase exhibition About Faces: The Postwar Boom in Craniofacial Knowledge *(1997) explored how the application of medical research to everyday life in the past fifty years has changed our perceptions and understanding of the way we look. It featured dental research, plastic surgery and facial prostheses, protective wear, and commercial skin products.*

dimensional displays of the old Arts and Industries Building. Artifacts were placed in large, well-lit cases. Colorful labels and images were silkscreened onto the backs and sides of the cases, providing additional information and context for interpretation. Platforms were built for such large objects as the pharmaceutical manufacturing equipment. A major innovation was the creation of period rooms for a more in-depth view of history. Among the most memorable were the *1890s American Drug Store*, the *Old World Apothecary Shop*, an early-twentieth-century bacteriology laboratory, a late-nineteenth-century hospital ward illustrating nursing, and reconstructions of the dental offices of Greene Vardiman Black, Edmund Angle, and Edmund Kells. Curators Blake and Hamarneh were primarily responsible for the new installations, which were completed in 1966.

Audrey B. Davis, the first trained historian of science specializing in the history of medical instrumentation and the first woman to serve as curator in the Division, was recruited in 1967. I joined her in 1977, just after receiving my doctorate in the

history of science with a particular interest in the history of public health. Barbara Melosh, a social historian of medicine, came aboard in 1983 and remained with the Division until 1991.

The scope of collecting and interpretation expanded to encompass broader areas of health and medicine, including the contributions of women and minorities to medicine, rehabilitation medicine, occupational health, psychological testing, nutrition, contraception, the Public Health Service, new imaging modalities (including ultrasound, computed tomography, and magnetic resonance imaging scanning), and the emergence of such new fields as molecular biology, genetic engineering, and molecular medicine. Thematic exhibits supplemented the more traditional subject area displays. They included *Triumph Over Disability* (1973), *Pain and Its Relief* (1983), and *Search for Life* (1987).

The Museum of History and Technology was renamed the National Museum of American History in 1980 and in 1993 began strategic planning, including a redefinition of its mission and eventual reorganization. In 1994, the research, registration, collections management, and preservation functions were combined in the Office of Curatorial Affairs. The collections documentation, registration, and preservation functions were subsumed under Collections Management Services. The reorganization collapsed eighteen curatorial divisions into five under the administration of the History Department. The medical collections became part of the Division of Science, Medicine and Society, which also includes the biology and physical sciences collections. The reorganization helped to bring together additional staff interested in the history of the health sciences, including G. Terry Sharrer and Patricia Peck Gossel, both of whom are contributors to this volume.

Collecting goes apace in many broad areas of the health field and with many significant acquisitions every year. You will get a taste of new as well as old highlights in the following articles. And, while the Hall of Medical Sciences closed in 1991 to make way for the *Science in American Life* exhibit and the Hands-On Science Center, the next major exhibit, tentatively titled *Health in America*, should premiere at the turn of the millennium. In this way, we will carry on the more-than-century-long tradition of collecting, preserving, documenting, and interpreting our nation's medical heritage.

♦

EDITOR'S NOTE

Information on particular objects in this introduction, and throughout the volume, are from collection records of the Smithsonian Institution.

Notes

1. Information about the history of the Smithsonian Institution is taken from the sources cited in the "General References on the History of the Smithsonian" section of the "Selected Bibliography," especially James Conaway's book, *The Smithsonian: 150 Years of Adventure, Discovery, and Wonder.*

2. William J. Rhees, ed. and comp., *The Smithsonian Institution: Documents Relative to Its Origin and History, 1835-1899*, 2 vols. (Washington D. C.: Government Printing Office, 1901),1:6.

3. Ibid., 1:432.

4. Paul H. Oehser, *Sons of Science: The Story of the Smithsonian Institution and Its Leaders* (New York: Henry Schuman, 1949), 66.

5. J. M. Toner, *Anniversary Oration Delivered Before the Medical Society of the District of Columbia, September 26, 1866* (Washington, D.C.: Cunningham and McIntosh, 1869), 29–30.

6. "Materia Medica Collection of the Smithsonian Institution," *Journal of the American Medical Association* 28 (1897): 467.

7. *Annual Report of the Board of Regents of the Smithsonian Institution* for 1883, p. 190.

8. Today, known as the Armed Forces Institute of Pathology, it is located on the campus of the Walter Reed Army Medical Center. The museum part of the Institute has been renamed the National Museum of Health and Medicine. From 1888 to 1955, the Army Medical Museum was located on the Mall, next to the Arts and Industries Building. For more on the Army Medical Museum see Robert S. Henry, *The Armed Forces Institute of Pathology: Its First Century 1862-1962* (Washington, D.C.: Government Printing Office, 1964), especially p. 59 for early exchanges of collections between the Smithsonian and this museum.

Treasures from the Smithsonian's extensive collection of bloodletting instruments (from left to right): an eighteenth-century thumb lancet and case, an alcohol lamp, a spring lancet, two cupping glasses, and a scarificator.

From Stethoscopes to Artificial Hearts

Judy M. Chelnick

The Smithsonian's large and diverse medical collections encompass artifacts from the ordinary and mundane to the complex and extraordinary. From stethoscopes to a complete operating theater for open-heart surgery, the collection is rich in both objects and supporting documentation.

In 1898, the Smithsonian Institution's *Annual Report* announced the expansion of the Section of Materia Medica to the Division of Medicine. The goal was "to illustrate the history of medicine, or the evolution of ideas concerning disease and its treatments."[1] That same year Curator James M. Flint walked just a few short blocks from the U.S. National Museum to the Center Market on Pennsylvania Avenue and acquired the first objects for the newly named division.

Within the depths of an old accession book, Flint's very precise handwriting records each object he "purchased of [a] colored woman at Center Market": a rabbit's foot amulet, peony roots, horse chestnut, scarlet silk, and human hair.[2]

This eighteenth-century, English-made trephination set was owned and used by Charles McKnight, the Surgeon General for the Hospital of the Middle Department during the American Revolution. After the war, McKnight taught surgery and anatomy at Columbia College in New York City. Photograph by A. Russetti.

Other early acquisitions were an iron nail, cautery iron, leeches, spring lancet, thumb lancet, scarificator, and a cupping glass. The items reflect both Flint's and the Museum's interest in folk medicine, self-treatment, and bloodletting, one of the most ancient surgical procedures. Over the years, the rich bloodletting collection has continued to grow, and it includes both European and American instrumentation. Much of the collection is documented in the 1979 publication *Bloodletting Instruments in the National Museum of History and Technology*.[3]

Anesthesiology and Surgery

New exhibitions provided new opportunities to collect. Private individuals, realizing the importance of preserving their own or their ancestors' contributions and legacies, began to donate to the Museum. Artifacts from the early days of anesthesiology, for example, were given by descendants of Crawford W. Long and William J. Morton, co-discoverers of inhalation anesthesia. Pittsburgh dentist Harry W. Archer gave not only anesthesia machines, inhalers, and a variety of anesthetics but also the memorabilia of Horace Wells, another co-discoverer of inhalation anesthesia. Archer's gift included a lovely set of watercolor miniatures of Wells and his wife Elizabeth.

The collection of surgical instruments and surgical sets, many of which are on display throughout the Smithsonian, repre-

sents the evolution of medical technology. Among eighteenth-century collections are the amputation case and bloodletting set used by Charles McKnight (1750–1791), the Surgeon-General for the Hospital of the Middle Department during the American Revolution and the surgical set that belonged to Colin Mackenzie (1775–1827), crafted by J. T. Cassel, one of Baltimore's earliest surgical instrument makers. A Civil War instrument set belonging to [J.] B. Cline, manufactured by G. Tiemann & Company of New York, is a recent acquisition.

Another highlight is the superb surgical set that belonged to John Maynard Woodworth (1837–1879), who served as the first Surgeon General of the United States Public Health Service from 1871 to 1879. The six removable trays of the rosewood and brass-trimmed case accommodated more than a hundred instruments. The case was a collaborative effort by two of New York City's leading instrument makers, William F. Ford & Company and Shepard and Dudley.

Health of Mothers and Infants

More than 150 instruments for the delivery of babies are in the Smithsonian's extensive collection of gynecological and pediatric equipment. There are two complete eighteenth-century French delivery sets as well as several nineteenth-century patent models for infant bottles.

More recent artifacts of historical interest include an early example of the Hess incubator, which was invented in 1922 by Julian Hess, who established the world's first premature infant nursery in Chicago. The first phototheraphy unit built in the United States (1966) serves to illustrate the first controlled study of neonatal jaundice.

Intelligence and Aptitude Testing

Donations from the University of Maryland, Cornell University, and Skidmore College make up the major portion of the Museum's psychological apparatus collection. The collection has well over two hundred artifacts: psychological tests (including paper and pencil tests), teaching machines, and apparatus for data analysis. The collection's strength is the formative years of 1910–1940, the time when psychologists established themselves as authorities with tests for intelligence and aptitude. Many of the instruments in the collection were made by Max Edelman, C. H. Stoelting, Max Kohl, and Rudolph Koenig, leaders in manufacturing some of the finest experimental psychological apparatus in Europe and the United States at the turn of the twentieth century.

Cardiology

Among the Smithsonian's twentieth-century collections, the cardiology holdings are especially significant. The initial acquisitions date back to 1922, when two sphygmographs and a sphygmomanometer were acquired for exhibition.

In 1954, when the Second World Cardiology Meeting convened in Washington, a special Smithsonian exhibition commemorated four decades of electrocardiology development. The exhibit included a contemporary electrocardiogram (EKG) as well as the EKG used in the 1930s by cardiologist Frank N. Wilson in his pioneering electrocardiography experiments at the University of Michigan. Also reflected in the cardiology holdings are the groundbreaking achievements of Claude S. Beck, George E. Burch, Denton A. Cooley, Charles A. Hufnagel, and Adrian Kantrowitz.

Equally important among the names

One of many artificial hearts in the cardiology collection, this heart pump was the first to be implanted in a human on April 4, 1969, by cardiac surgeon Denton A. Cooley.

that appear in the donor file are the physicians and surgical instrument companies who have never made the headlines but have preserved their profession's history by generously donating the workhorses of their trade to the Smithsonian.

Thanks to such gifts, researchers can examine the history of heart valves from Hufnagle's first experiments in cardiovascular surgery in the late 1940s to what has become the standard in the industry. Likewise, the collection of electrocardiographs represent the major changes in that field, beginning with the first electrocardiograph brought to this country by Alfred E. Cohn in 1909 (donated to the Smithsonian in 1980 by George E. Burch). Additional cardiology collections include representative stethoscopes, pacemakers, balloon pumps, and teaching models of the heart.

Artificial Organs

The artifacts receiving the greatest attention in recent years have been artificial hearts. The Smithsonian has a variety of experimental models: the Lindbergh-Carrell perfusion pump; the 1952 Dodrill-GMR mechanical heart developed at General Motors Research Laboratories and used to bypass the heart; William Sewell's pump for bypassing a dog's right heart, which was built from Erector Set parts during his medical student years at Yale University; the totally implantable artificial heart used in a calf during the 1969 trials funded by the National Heart, Lung, and Blood Institute of the National Institutes of Health; and a Jarvik-7 heart pump, the first device authorized as a bridge to transplantation for patients awaiting a donor heart.

The Museum has recently acquired another important collection from the pioneer of artificial organs, Willem J. Kolff. Current holdings include a Kolff-Brigham artificial kidney, an early hemodialysis machine used at Boston's Peter Bent Brigham Hospital, and artificial veins, arteries, joints, hips, and numerous prosthetic limbs.

Endoscopy

Most of the instruments in the endoscopy

collection came directly from manufacturers. The artifacts are closely associated with innovative surgeons, including Rudolf Shindler (1888–1968), who worked closely with instrument makers in Germany and the United States to develop a practical and safe gastroscope; Chevalier Jackson (1865–1958), pioneer in the field of bronchoscopy; Leonidas H. Berry, whose *Gastrointestinal Pan-Endoscopy* became a classic text; and the team of Basil Hirschowitz, Wilbur Peters, and Lawrence Curtiss, who invented the fiberscope, the first use of fiber optics in medicine.

The Importance of Documentation

Curator James Flint wrote in 1905: "The value of a museum specimen, as such, is largely proportionate to the amount of information which accompanies it, and to which it directs attention. Therefore, the facts regarding the nature, source, mode of preparation, attributed virtues, mode of use, and attendant ceremonials, together with the localities where used, and the class of people using it, should be given in the fullest possible detail."[4]

Following Flint's advice, museum staff continue to collect as much background information as possible to document each acquisition. Donors are asked for supporting documentation related to their work as well as to the specific item being donated. George Burch, the renowned cardiologist and avid collector of medical artifacts who seems never to have thrown anything out, provides an excellent example of the enthusiastic response. Along with Cohn's electrocardiograph, Burch included original tracings from the EKG and a copy of a 1953 letter written to him by Cohn reminiscing about the history of the instrument. Many of the files, particularly those compiled since the 1980s, contain a tremendous amount of information. Researchers can often find biographies of the inventor, newspaper clippings, inventories, professional articles, and photographs.

This brief note, written in 1970 by Claude S. Beck after he had retired as Professor of Surgery at Case Western Reserve University, is preserved in his accession file. It is illustrative of the kind of donation letters received.

> Dear Sir:
> I have in my possession the defibrillator that reversed death in the first human heart. This occurred in 1947. This is an historical achievement upon which all heart surgery is based. It is the basis for reversal of the fatal heart attack. If the Smithsonian Institute [*sic*] cares to accept this defibrillator, I shall present it to the Institute.

Artifacts as Teaching Tools and Art

One of the most beautiful collections is a small but representative set of anatomical models. Indeed, even the engraved and lithographed charts that accompany the intricately detailed, three-dimensional, papier-mâché and wax models are truly works of art. Of importance for both exhibition and study purposes, the models reveal how medicine and biology were taught during the nineteenth and early twentieth centuries.

Among these anatomical models are ten wax models that were once part of a large University of Pennsylvania collection assembled about 1850 by Professor of Medicine George B. Wood (1797–1879). The models portray certain contagious diseases and skin conditions once prevalent in the United States, such as cholera, syphilis, scabies, chancre, and eczema. The models were purchased at auction in 1986 and include six crafted by the British artist

Elegant papier-mâché anatomical model of the male body (55 cm) crafted by the nineteenth-century French model maker Louis T. J. Auzoux.

Joseph Towne (1808–1879), one of the most famous wax modelers of the period.

The Smithsonian is also fortunate to have several papier-mâché human anatomical models from the Paris workshop of Louis T. J. Auzoux (1797–1880), one of the world's leading model makers. *Établissement du Docteur Auzoux* is still in operation today. Among them is a 55cm male mannikin (1852), a cross section of an eye marked "Auzoux Doct fecit anno 1856," a model of a brain and an ear (1888), a larynx (1888), and a set of eight uterine models with fetus (ca. 1928).

Auzoux's model of the ear is typical of the attention to detail lavished on his creations. The ear, for example, is seven times the size of a normal ear and was purchased directly from the *Établissement du Docteur Auzoux* in 1975. It is brightly painted to highlight all of the blood vessels and tissues, and its sections can be disassembled to show the parts of the inner ear.

When French zoologists led by Georges Cuvier (1769–1832) developed the study of comparative anatomy, Auzoux added models of animals and plants to his repertoire. The Division of Science, Medicine and Society has recently acquired by transfer from the National Museum of Natural History a series of these extremely delicate, almost transparent Auzoux models illustrating the anatomy of the bird. The set was originally purchased for display at the 1893 World's Columbian Exposition. Also in that transfer is a fine model of a hen's egg, which was purchased for display at the 1895 Cotton States Exposition.

Another collection of wax models, not nearly as old, was assembled for a much different purpose. In 1995, a collection of wax casts of animal glands and organs made by the physiologist and surgeon George Crile (1864–1943) was transferred

to the Division from the Smithsonian's National Zoological Park. Crile created the models as part of a study to support his theory that as an animal's metabolism and energy expands, so does its brain size. Crile, one of the founders of the Cleveland Clinic Foundation in 1921, had hoped to place the models in a museum within the clinic. The fifteen models acquired by the Smithsonian are but a fraction of Crile's original castings of hearts, brains, and thyroid glands of a white whale, a lion, and an eagle. The animals were captured on hunting expeditions in the 1930s and shipped back to the United States for further study. Crile's dream of founding a Museum of Intelligence, Power, and Personality in which to showcase the collection was short lived.

While the anatomical models and charts are important in their own right, they also complement many other collections. For instance, Auzoux's model of the human ear augments an auditory collection of hearing aids and cochlear implants. Likewise, the eye and brain models supplement collections of ophthalmology and psychology. Included with the donation of three gastroscopes, from Jerome Weiss of New York City, were three boxed sets of teaching models that illustrate various pathologies of the stomach.

Among outstanding sets of equipment and instruments, there are electrotherapy and chiropractic apparatus, a surgical stapler collection, seventeenth- and eighteenth-century trephination sets, a prototype stereotaxic unit for neurosurgery, and a collimator helmet from the first gamma knife used in the United States.

Space restrictions prevent mention of all the collecting categories and treasures in the Smithsonian's Medical Sciences Collection. In addition to the documentary resources already mentioned, there is a vast photographic collection, including the Science Service Collection of photographs from the late 1920s to the early 1960s.

Although the emphasis has been on collecting and documenting the achievements of health care professionals, scientists, and the health care industry, Division staff have never lost sight of the patients and their perspectives on health and disease. The early interest in folk remedies and concern with the public health is testimony to that collecting point of view. More recently, for example, the Division has collected wigs, turbans, exercise equipment, videotapes, and health guides from three cancer patients. And in the future, the Division expects to collect more artifacts that broadly represent the patient's experience.

A colleague once referred to the medical collections at the Smithsonian as the boutique collection of the museum world. In many respects this is true, but it also houses a fine assortment of ready-to-wear in the National Collections.

♦

Notes

1. *Annual Report of the Smithsonian Institution* (Washington: U.S. National Museum 1898, and Government Printing Office, 1900), 29.

2. Accession Book, Department of Anthropology, Division of Medicine, Vol. XXX, Smithsonian Institution, Washington, D.C.

3. Audrey B. Davis and Toby Appel, *Bloodletting Instruments in the National Museum of History and Technology* Smithsonian Studies in History and Technology, No. 31 (Washington, D.C.: Smithsonian Institution Press, 1979).

4. James Milton Flint, M.D., U.S.N. (retired), "Directions for Collecting Information and Objects Illustrating the History of Medicine," *Bulletin of the United States National Museum* 39 (1905): Part S, 5.

Ophthalmology-Optometric Collections

Katherine Ott

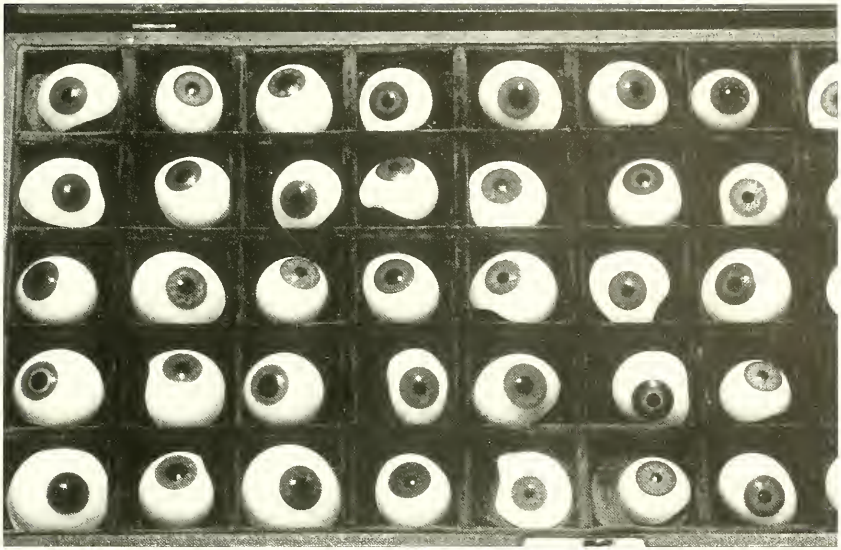
Objects and artifacts are, among other things, material evidence of the intellect and obsessions of cultures. The Division of Science, Medicine and Society has a splendid record of the havoc rendered on eyes by modern society. Accident, minor injury, and illness caused partial and total loss of sight on a shocking scale in the nineteenth and early twentieth centuries. The Smithsonian's ophthalmic collection traces the history of such things as farmers kicked in the head by horses, stonecarvers blinded by flying debris, motorcyclists with faces covered in mud, and 1980s teenagers struggling to adjust to contact lenses.

The collection contains approximately twenty-five hundred objects, of which two thousand are spectacles from the seventeenth century to the present. The remainder of the collection consists of nineteenth- and twentieth-century diagnostic equipment, therapy items, and related pieces used by optometrists and ophthalmologists. Among them are sight-testing instruments such as Jaeger test type charts, Holmgren's colored wool test for color blindness, a chromatophotometer, perimeters, and pupillometers.

Before the invention of the ophthalmoscope in 1851, knowledge of the eye was limited to its surface structure or what could be determined from a lifeless autopsy. The ophthalmoscope brought a means to optically project light behind the eye of a living person; and to see, for the first time, an actual living organ (the optic nerve, eye, and fundus). In its wake came a mass of new knowledge about neurological illness as well as vision loss. Ophthalmoscopes are represented by over forty devices that cover most major designs from Hermann Ludwig von Ferdinand Helmholtz (and subsequent modifications by Richard Liebreich, E. Rekoss, Edward Loring, Edmond Landolt, and Hermann Jakob Knapp) to electric otoscopes of the 1960s. Several years ago, the Division acquired the prototype of the indirect binocular ophthalmoscope created by Charles Shepens from scraps of metal collected after the Germans bombed London during World War II.

Interpretation of eyewear addresses issues of aesthetics, consumption, capitalism, industry, manufacturing, and vanity. It is fitting, then, that by far the largest part of the collection is that of eyewear. Most of the spectacles came as donations from two collectors: ophthalmologist and scholar William Rosenthal,

A small assortment of spectacles from a large and diverse collection of eyeware. The slit style (right rear) is an Eskimo design for reducing snow glare.



A boxed set (c. 1865) of 50 glass eyes, from brown to hazel to green to blue of various sizes and shapes and complete with red veining, was probably made in Europe and intended for Civil War veterans who required them. They come in a velvet-lined, compartmentalized wood case stamped "Prof. James T. Davis, 127 East 15. Street, New York" who was probably an eye fitter.

who donated numerous surgical instruments and other objects related to twentieth-century practice, and Eric Muth, a Connecticut optician who consulted with Smithsonian staff for several years before donating his extensive collection in 1984.

All major styles of eyewear are represented, including examples from as early as the Middle Ages (Chinese) to 1990s trifocals, with lorgnettes, monocles, opera glasses, pince-nez, sunglasses, and safety goggles in between. Likewise, there are examples from major manufacturers and distributors, including Meyrowitz, American Optical, and Bausch and Lomb.

The examples of refracting apparatus document research in anatomy of the eye and physiology of vision: two ophthalmometers from the 1890s; a ski-optometer; several trial lens sets, including one with sales receipts and order forms from the late-nineteenth century; a prism spectacle holder with four prisms; and a Maddox rod test lens. These reflect shifts in the importance of physiological problems to be solved (such as astigmatism and glaucoma) and methods for solving them.

Kevin Touhy was the inventor of the modern corneal contact lens. Following his death, his widow donated several original objects and papers to the collection, including eyemolds for shaping the lenses. These complement models for the earlier scleral design lens. Intraocular lenses (for

The first clinical use of contact lenses came in the 1880s. The corneal lenses and molds used to make them, shown here, were developed by Kevin Tuohy in the late 1940s and 50s. They were significantly smaller and lighter than earlier types.

implantation), which have revolutionized cataract surgery have also been collected, including the Binkhorst, maltese cross, and several other types.

Among the unique objects in the collection are artificial eye-related materials donated by Milton Wirtz, who was among the team of World War II army dentists who perfected the use of acrylic resin for artificial eyes. Prior to the development of plastic eyes, German-made glass was used. As a result of war shortages, Wirtz was detailed to find a suitable replacement. The Smithsonian collections also have display boxes of "reform" eyes (the late-nineteenth-century design used for patients who still retained the globe) as well as mid-twentieth-century implants.

Without doubt, more specialized instruments exist for ophthalmology than for any other surgery. There are, for example, multiple designs for each use of the forceps: capsular, iris, corneal, and fixation. Other instruments used to cut cataracts and repair damaged tissues include tenotomy knives, keratomes, spoons, loops, spatulas, scissors, sutures, iris hooks, and corneal trephines. The lachrymal syringe, well represented in the collection, not only predates the hypodermic syringe by some 120 years but also introduces some of the principles perfected in the latter.

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Medical Imaging

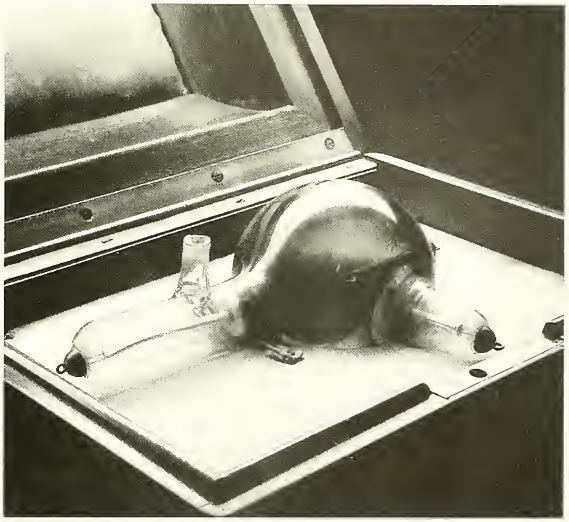
Ramunas Kondratas

Medical imaging technologies, broadly construed, are ways of visualizing the human body. They range from anatomical drawings and models, to instruments for looking into body parts (such as specula and endoscopes), to X-ray machines and the latest imaging modalities—ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and positron-emission tomography (PET) scanning.

The Division of Science, Medicine and Society has a number of very beautiful anatomical drawings and charts illustrative of medical imaging, as does the Dibner Rare Book Library on the first floor of the Museum.

The X-Ray

The radiology collection is especially rich, both in objects associated with famous scientists and in breadth and depth. In 1956, the Smithsonian acquired one of the first X-ray tubes used by Wilhelm Konrad Roentgen (1845–1923), professor of physics at the University of Würzburg, Germany, who on November 8, 1895, discovered this new kind of radiation. According to accession records, it was Roentgen's third X-ray tube. This tube was purchased for the Smithsonian by the General Electric Company and flown to Washington, D.C., by Trans World Air Lines. In one of the more unusual but fitting welcomes into the collections for a national treasure, a special presentation ceremony was arranged at National Airport (recently renamed the Ronald Reagan Washington National Airport).



One of the early tubes used by Wilhelm Konrad Roentgen during his experimental X-ray research in 1895. Photograph by A. Russetti.

Roentgen's first two tubes are preserved, respectively, at the Physical Institute in Würzburg and at the Deutsches Museum in Munich.

Emil H. Grubbe (1875–1960), a Chicago physician, was among the first to apply Roentgen's rays in clinical practice, treating a cancer and a skin disorder in 1896. In 1941, Grubbe donated five glass vacuum X-ray tubes, including three designed and patented by him, to illustrate the use of X-rays for therapeutic purposes from 1898 to 1902. His sad but heroic

research began when he unknowingly exposed himself to X-rays from William Crookes's tubes in 1895, before Roentgen announced his discovery. The radiation burns gave him the idea that X-rays might have therapeutic value in treating diseased tissue. Because of this exposure, Grubbe underwent ninety-two operations during his lifetime, eventually leaving him disfigured and crippled.

Induction coils and static machines—early methods for generating enough electrical current through a partially evacuated glass tube to produce X-rays—are also represented in the radiology collection. The Grosse Flamme (Great Flame), developed in 1904 by Albert B. Koett, used an induction coil that produced a twelve-inch spark, the largest usable spark at the time. It was donated to the Division by the Kelly-Koett Manufacturing Company of Covington, Kentucky, in 1947. A large and impressive static machine that had been used in Washington, D.C., for making X-ray photographs was acquired in 1957 and put on display in the Hall of Medical Sciences. It was the Morton-Wimshurst-Holz Influence Machine, manufactured by the Bowen Company of Providence, Rhode Island, and patented in 1889.

Another piece of historic radiology equipment included in the collection, is the first portable X-ray machine used successfully on a battlefield. Owned by the British Red Cross, it was used in the Balkan Wars of 1912; before that, all medical X-ray work was confined to hospitals, far from the front line. This unit was made by Harry W. Cox and Company of London; it was used by Harry Cox, who died of burns received from it.

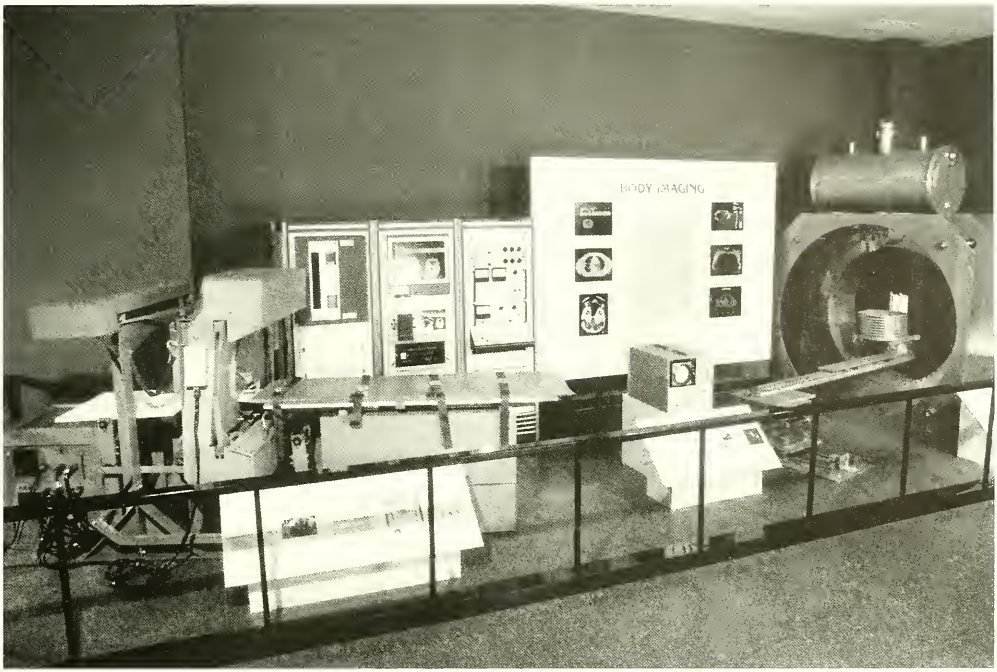
The Division's most significant acquisition was in 1978, when over 250 objects, much related literature, and reference materials were donated by the American College of Radiology in Chicago. The collection numbered nearly 160 X-ray tubes of many varieties, X-ray machines (including several from the first decade of this century), X-ray films, fluoroscopes, X-ray generators, exposure calculators, and other related materials.

Beyond the X-Ray

Since the 1970s, the emphasis has been on collecting and documenting other emerging imaging modalities, a mission that must be highly selective because of space limitations. The Division has collected the 1963 prototype CT scanner built and used by Allan M. Cormack, who together with Godfrey Hounsfield of England, received the 1979 Nobel Prize for Physiology and Medicine in recognition of their work in developing computer-assisted tomography.

The collection also includes the first whole-body CT scanner, an automated computerized transverse axial (ACTA) scanner, invented by Robert Ledley and put into clinical operation in 1974 at the Georgetown University Medical Center. A great deal of documentation accompanied the scanner: photographs of its construction, an early 16mm sound movie of the scanner in action, copies of the earliest images generated, numerous articles and press releases, drawings, original designs (including a small balsawood model), and even wiring lists. In addition, Smithsonian staff videotaped oral histories with Ledley, both in front of the scanner and in his laboratory at Georgetown University.

In the area of MRI (formerly known as nuclear magnetic resonance imaging), the Division has a 1977 prototype built by one of its pioneers, Raymond Damadian, who proudly named his scanner "The Indomitable." It nicely complements the



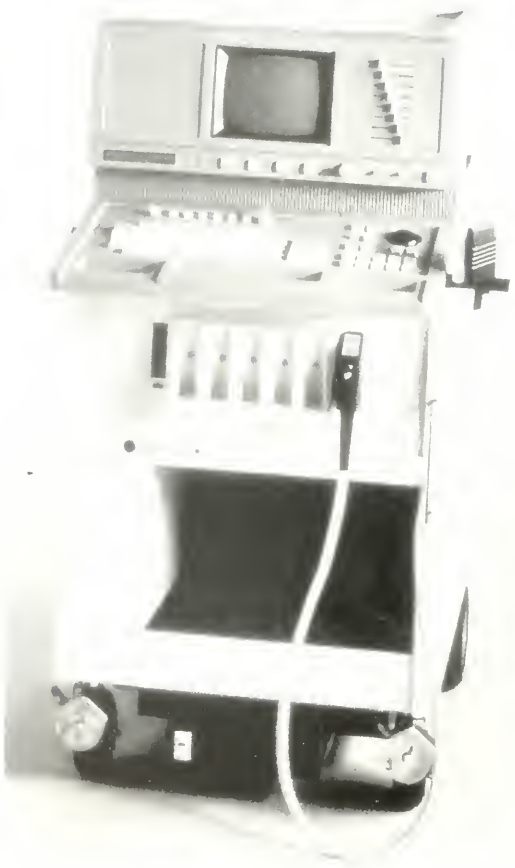
This 1986 exhibit on body imaging featured the first whole-body CT scanner invented by Robert Ledley (on the left), an ultrasound fetal monitor (in the middle), and Raymond Damadian's prototype MRI scanner, "The Indomitable" (on the right).

National Bureau of Standards electromagnet (acquired in 1986), which was used in 1972 for the first *in vivo* demonstration of the nuclear magnetic resonance technique, in which a tumor on the tail of a live mouse was visualized.

Ultrasonic Technologies

Ultrasonic waves, the very-high-frequency sound waves, were applied in both industry and medicine between the world wars. But ultrasound was not adapted to diagnostic medical technique until the late 1940s and early 1950s, and as a medical imaging technique not until the mid-1960s. Two instruments that illustrate the most common ultrasound medical applications—a fetal monitor and a B-Scan ultrasonoscope for scanning the eye—are part of the collection.

Two recently acquired ultrasound machines from Acuson Corporation of Mountain View, California, represent significant advances in medical sonography. The Acuson 128 system, introduced in 1983, is a pioneering example of computed sonography. Based on a hybrid



The Acuson 128 ultrasound scanner, introduced in 1983, marked the beginning of computed sonography.

analog/digital computer, it was specially designed to accommodate the data-processing requirements of real-time image formation. The Sequoia 512 system, which was introduced in 1996, is the first-ever utilization of both phase and amplitude information from sound waves to produce fine-quality images and much more detailed diagnostic information; conventional instruments utilize only amplitude information. Both instruments arrived with excellent records of manufacture and marketing, to which Smithsonian staff have added videotaped oral histories.

The Division is currently investigating the possibility of collecting artifacts from the newest of the imaging modalities, PET scanning, whose reliance on cyclotrons and radioactive isotopes pose an unusual challenge to the modern curator.

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Toothkeys to Prosthodontics

Philip D. Spiess II

When the United States National Museum opened in the Arts and Industries building in 1881, it began to acquire the first medical collections. No dental items were included or collected, however.

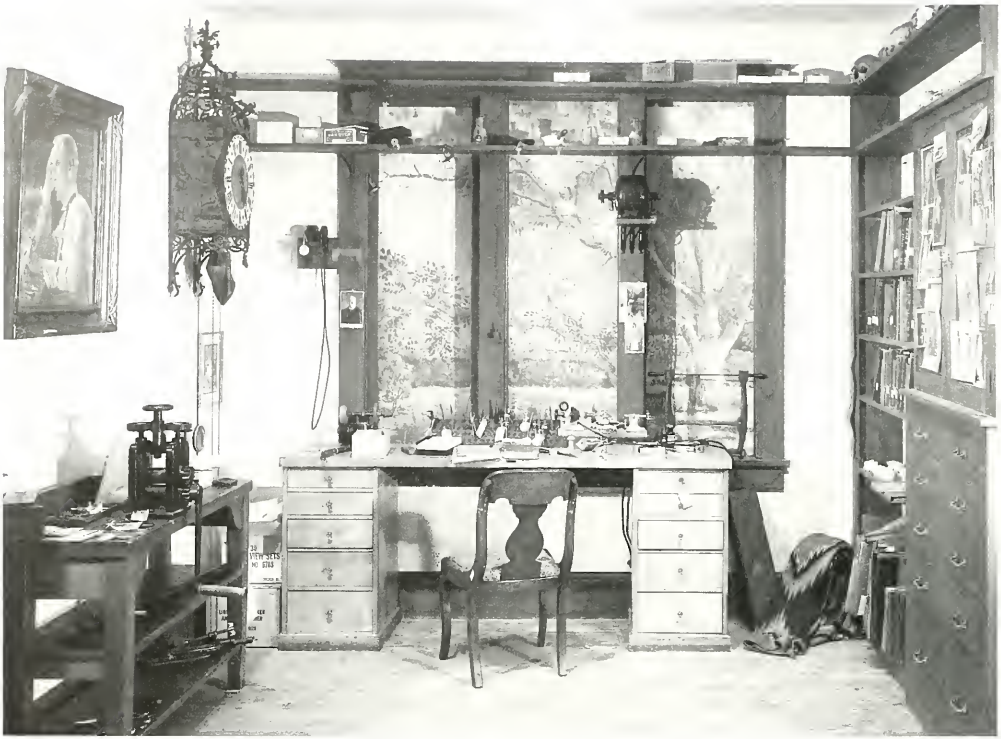
True, Assistant Director George Brown Goode's ambitious scheme (anthropologically-based) to acquire "Ultimate Products and Their Utilization" included "medicine, surgery, pharmacology, hygiene, &c.," but those products tended to be purely pharmacological (materia medica). His *Annual Report* for 1881 reported optimistically that "important contributions have been promised by several manufacturing and commercial houses," including "the appliances and operations of dentistry, by the S. S. White Manufacturing Company, of Philadelphia," but the records show that no such contribution was forthcoming.[1]

Some forty years later, in 1924, Charles Whitebread, Assistant Curator in what was then the Division of Medicine, set up the Public Health Gallery in the Arts and Industries Building, comprising exhibits deposited by the National Committee on Exhibits Showing Advances in Sanitary Science, a committee of government bureaus working in public health. Intended to educate the public in health and sanitation, the gallery eventually featured an exhibit on oral hygiene, which displayed (among other things) a cotton roll toothbrush and specimens of dental floss (contributed by Johnson & Johnson), twelve toothbrushes of various sizes and styles (contributed by S. E. Howard's Son & Company), and six toothbrushes contributed by the Pro-phy-lac-tic Brush Company of Massachusetts. Any display on the history of dentistry was yet to come.

A variety of early American dental keys. Photograph by A. Russetti.

First Dental Models

But come it did one year later, 1925, when a large collection of original patent models (including 150 dental items) was transferred from the Patent Office. Among the items were a handsomely carved pair of 1870s wooden dental forceps from a Dr. Robie, artificial teeth made of diverse materials, models of vulcanizers, and an assortment of forceps, gold pluggers, and articulators. The pieces reflected how the craft of dentistry had evolved through woodworkers, plaster molders, ivory turners, smiths, and clockwork and jewelry makers; the nineteenth-century dentist had often made his own tools, which he then



The re-created office workshop of Dr. Edward Angle displays, along with his portrait, equipment he used to develop the modern practice of orthodontia.

patented and sold to a commercial manufacturer. For that reason, dental patents exemplified a specialized American craft, one worth representing in the Department of Arts and Industries.

By 1930, significant objects in the history of anesthesiology and radiology were being acquired, many of which had been utilized by or developed in conjunction with dental practice.

Fifties Expansion

Post-World War II prosperity led to a distinct improvement in Smithsonian finances and staffing. By 1951, dentistry and oral hygiene were listed among the subjects for which the Division of Medicine and Public Health would develop "historical, modern, scientific, technical, and popular exhibits and study collections." Among the objects that might be

collected to carry out those purposes were "instruments, equipment, pictures, exhibits, dioramas, models, and literature." The Division also offered "docent service to classes from medical, pharmacy, and dental colleges, and to groups of students, technicians, and nurses."[2]

With the appointment of George B. Griffenhagen as Curator in 1952, the medical science collections were increased in scope and quantity, and dentistry became an official section. Exhibits in the Arts and Industries Building were expanded to include a case on dental instruments, an exhibit on the manufacture of dentures, and a display of prints of dentists and their patients, a gift of the American Dental Association.

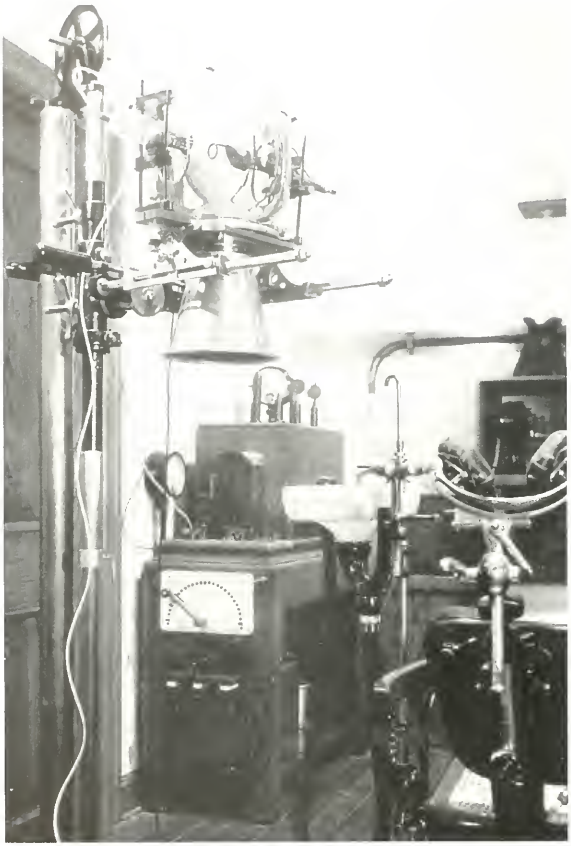
By far the most interesting dental exhibit was the circa 1895 Jacksonville, Illinois, office of Greene Vardiman Black (1836–1915), a pioneer in American operative dentistry and dean of the Dental School at Northwestern University from 1891 to 1915. Northwestern had displayed Black's equipment and memorabilia at the 1918 meeting of the National Dental Association in Chicago and later in a period-room setting at its Evanston, Illinois, campus. Northwestern presented the collection, which includes an early Archer dental chair and the foot-powered dental engine designed by Black in 1871, to the Smithsonian in 1954, and it went on exhibit shortly thereafter.[3]

In 1957, as the Smithsonian was reorganizing and planning for a new Museum of History and Technology building on the Mall, the Division of Medical Sciences was at work on the creation of Halls of Medical Sciences—including a Hall of Dentistry. The dental profession responded generously to solicitations for historical items, and a special committee of the American Academy of the History of Dentistry was set up to assist the process. The cooperative effort paid off handsomely. Four magnificent collections were acquired by 1966, when the Hall of Dentistry opened.

Building the Collection

The first donation came from the University of Pennsylvania. Much of that material had been part of the Thomas W. Evans Museum and Dental Institute of the university's School of Dentistry. Evans (1823–1897), a prosperous native of Pennsylvania who established a practice in Paris in 1848, had been private dentist to many of the crowned heads of Europe, most notably Emperor Napoleon III and his consort, the Empress Eugenie. In 1870, Evans attained international fame when he engineered the Empress's escape from an inflamed Paris and a collapsing Second Empire. The Evans Museum was opened on the University of Pennsylvania campus in 1915 but was dispersed at the end of the 1950s due to the need for more classroom space. The Smithsonian received a portion of Evans's dental instruments and examples of royal bridgework.

The next big donation came in 1960 from the S. S. White Dental Manufacturing Company of Philadelphia, one of the country's largest producers and distributors of dental implements and equipment. In addition to their own products, the company sent samples from its "Model Room" of historical pieces from a variety of manufacturers: anaesthesia inhalers, articulators, four display cases of handpieces, a circa-1864 Harrington wind-up spring-driven dental engine, and such rare items as early pelicans and dental keys, automatic engine mallets, and bow drills. Especially useful to researchers was the extensive collection of trade catalogs.



Dr. Charles Edmund Kell's office features early X-ray equipment (c. 1916) which he applied to the practice of dentistry. Notice the compression tube, unusually large for dental work, immediately below the X-ray tube itself.

The laboratory workshop and personal memorabilia of Edward H. Angle (1855–1930), who was often considered the "Father of American Orthodontia," constituted the next major collection. It arrived in 1962 from the University of Illinois College of Dentistry. Angle pioneered techniques and equipment for straightening misaligned teeth. He designed and promoted the expansion arch (often the torment of the young), the gold band that exerts controlled pressure on out-of-position teeth.

The fourth major donation—office equipment and radiology apparatus belonging to Charles Edmund Kells (1856–1928)—had a singular history of heroic experimentation and misfortune. Kells was an innovator of electrical applications for dental tools (the electric suction pump was his invention) as well as the preeminent pioneer in the adaptation of X-ray technology to dental practice. Tragically, his repeated exposure to X-rays during years of experiments and dental treatments resulted in damage that required thirty-five progressive amputations of his left arm, and he committed suicide at the age of seventy-two. The previous year he had donated his books and professional equipment to Tulane University for the Kells Memorial Library and Museum, which was supervised by the Tulane Dental School. In a final stroke of disaster, the dental school suspended operations the same year of Kells's death. Consequently, the contents of his museum were (to quote an observer) "thrown around and most everything was lost or stolen." What eventually came to the Smithsonian in 1964 (through Kells's daughter and Tulane University) was salvaged from "a rough storage room . . . under the Tulane stadium," where it had been dumped by order of the dean of the School of Medicine![4]

As the final touches were being put on the Hall of Dentistry, the Smithsonian engineered a fruitful loan that rounded

out the exhibits. The Baltimore College of Dental Surgery, founded in 1840 as the first dental college in the world, had maintained a dental collection and museum for many years. But with expansion of the College (which merged with the Dental Department of the University of Maryland to become the University's School of Dentistry) and the planning of a new facility, its museum had been dismantled and the collections had been placed in storage. In 1966, the Smithsonian arranged a ten-year loan, which continued through 1995!

The Hall of Dentistry

With those four major donations and the long-term loan, plus the somewhat earlier gift from Northwestern University, the Hall of Dentistry presented an impressive history of the field: the reconstructed period room-style offices of dentists Black, Angle, and Kells; exhibit cases of very early dental operative instruments; early and unusual examples of artificial teeth and dentures; and a portrayal of the emergence of modern dental hygiene.

In 1967, the Columbia University School of Dental and Oral Surgery donated the Charles H. Land collection. A developer of the type of dentures retained by capillary action (1885), Land was such an artisan that he crafted a set of artificial teeth (now at the Smithsonian) for his dog! In 1970, Columbia University added another 1,555 dental instruments and artifacts.

Among the more fascinating examples of dental technology and practice in the collections are twenty-four dental chairs (the earliest dating from 1862), including at least six Archer chairs, a Johnston Bros. chair, S. S. White-manufactured chairs, "The Allison" chair (ca. 1890), a Harvard chair (ca. 1910), the "Ideal Columbia" (ca. 1910), and some more recent Ritter and Syntex chairs.

This oversized (about 25.5 in. high and about 13.5 in. broad) wooden molar was an attention-getting sign for its owner's office. It was presented to the Smithsonian in 1978 by William L. Walters of Washington, D.C.

Other significant reminders of the American dental past are a wooden dental office sign, a giant third-molar "tooth" with three roots (given in 1978 by William L. Walters of Washington, D.C.); an early American-made toothkey with a rotating bolster (circa 1820–1830); a Killam-patent toothkey (circa 1860) that claimed to remove the tooth without breaking the jaw; a Sharp dental draw press (circa 1918) of fifteen punches in graduated sizes, used for making gold shells for seamless crowns; and a collection of objects relating to the

career of early dental hygienist Frances G. Meltzer.

Documenting Modern Practice

In 1993 the dental office of Paul Wilhelm Rieser was donated to the Smithsonian by his heirs. Rieser completed his dental degree in Germany in 1933 but fled to the United States during the Nazi persecution of Jews. He earned a degree *cum laude* from the University of Pennsylvania in 1937 and established an independent office in New York City in 1940, where he practiced for the next fifty-two years. His office was one of the last of the old-style dental offices in which the practitioner stood to work, moving between the patient's chair, the instrument cabinet, and the laboratory work table. This type of office was generally replaced in the early 1960s by the more modern "sit-down" office, in which an efficient dental unit places everything within easy reach of the practitioner, who sits working at the side of the patient's reclining, contoured chair.

Mindful of the need to document dentistry's current practice as well as its past, the Smithsonian continues to seek out and acquire significant collections. One way this is done is through the exhibition program. As an exhibition is planned around a chosen topic, the planners may realize that while some objects needed are available in the collections, other key objects may not be. This prompts a search and acquisition effort. For example, the current *About Faces: The Postwar Boom in Craniofacial Knowledge* exhibit (see page 10) features a wide range of dental science elements—not only the use of fluoride in drinking water and toothpaste but also prosthodontia and the latest saliva testing for a variety of oral and systemic diseases. Such objects as children's chewable vitamin-enriched prescription fluoride tablets, fluoride toothpaste, enamel whiteners (to counteract mottling from too much fluoride), ribbon-arch and multicolored braces for orthodontia, saliva collectors, and an oral HIV antibody testing system were collected for the exhibit. They will remain a permanent part of the dental collection as the Museum begins to collect for the twenty-first century.

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Notes

1. Smithsonian Institution, *Annual Report of the Board of Regents of the Smithsonian Institution, Showing the Operations, Expenditures, and Condition of the Institution for the Year 1881* (Washington, D. C.: Government Printing Office, 1883), 91, 100.

2. Smithsonian Institution, *The Smithsonian Institution: A Description of Its Work* (Washington, D.C.: Smithsonian Institution, 1951), 87, 90.

3. National Dental Association, *Black Historical Exhibit: Prepared by Dr. William Bebb for the Meeting of the National Dental Association, August 5–9, 1918, Auditorium Hotel, Chicago* (Chicago: National Dental Association, 1918).

4. M. B. Varnado to Sami K. Harmarneh, Dec. 28, 1964, and Feb. 11, 1965.

The Pharmacy Collections

Diane L. Wendt and Eric W. Jentsch

On the fifth floor of the National Museum of American History, at the back of the Medical Sciences collections storage room, is the realm of the pharmacy collections. The narrow aisles maximize room for rows of storage units. Space is at a premium. The feeling of being crowded is immediate. Glass-doored cabinets yield a glance at the variety and quantity of specimens. Closed and stacked "quarter units" line another wall.

Several cabinets contain shelves of patent medicines, from Allan's Compound Extract of Celery to Zoa-Phora: Woman's Friend. Others have pharmaceuticals, from adrenalin chloride to zinc oxide. Mortars, pestles, and apothecary tools of all types abound. A row of cabinets is devoted to drug containers of every variety of size, shape, and material—from large ornate ceramic leech jars and glass show globes to the nineteenth-century unadorned stock drug bottles. A cabinet of crude exotic drugs contains a jar of tiger bones, dried hedgehog skin, and a bottle of iridescent Spanish flies. Quarter units reveal drawer upon drawer of pharmaceuticals, cosmetics, contraceptives, bandages, toothpastes, vitamins, and syringes.

All of this is only a sampling, because much of the pharmacy collection long ago overran the available space. Downstairs on the exhibit floor two entire "period" pharmacies—*The Old World Apothecary Shop* and *The 1890s American Drug Store*—are hidden behind the walls of current exhibitions.

The National Museum of American History's pharmacy collections storage area, with rows of glass-doored, steel storage cabinets for small and medium-sized objects.

Large manufacturing tools and machinery, along with boxes of crude drugs, reside in a warehouse-style storage facility in Suitland, Maryland. Hundreds of specimens of crude drugs and homeopathic remedies are in state-of-the-art storage at the Smithsonian's Museum Support Center, also in Suitland.

But the specimens and objects are only part of the story of the pharmacy collections. On a shelf in the storage room also reside two catalog books filled with the elegant script of the first recorders of the collections. The ledgers are an invaluable source for recreating the early history of the collection.

Chinese Medicines

A popular specimen from the Chinese Customs collection is a jar of tiger bones, clearly unprocessed, with teeth intact in jawbone. *The Catalog of the Chinese Imperial Maritime Customs Collection* of 1876 had this to say about the specimen: "The bones of the tiger—the *Leopardus brachyurus.* Mixed with hartshorn and the plastron of the terrapin formed into a tonic jelly, which is much used in the rheumatic affections of the joints, diseases of the bones, ague and debility." Several specimens from the collection of modern preparations from China also contain tiger bones, including Tiger Bone Medicinal Liquor, Tiger Bone Pills, and Tiger Bone Plasters. All are processed, bottled, boxed, and labeled with bright graphics.

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Centennial Legacy: Collecting the "Official" Pharmacopoeia, 1881–1950

On May 24, 1881, the first entry was recorded in the catalog book of the newly established Section of Materia Medica in the Department of Anthropology of the U.S. National Museum. It was a specimen of *Chrysanthemum album* (Catalog Number 49226, Accession Number 5892) from Hangchow-fu, China, one of more than six hundred specimens of materia medica comprising the collection of the Chinese Imperial Maritime Customs Commission exhibited at the Philadelphia Centennial Exposition in 1876. The transfer of that and other collections of crude drugs from the Centennial Exposition established materia medica as the focus of the medical collections for the next several decades.

The collection grew rapidly in the first few years, with large donations from American pharmaceutical and medical supply companies. Almost immediately, box upon box of materia medica specimens began arriving from such firms as Schieffelin and Company of New York, which sent nearly eight hundred specimens in 1881 and 1882. Other early donors included the Wallace Brothers North Carolina Supply Company, Parke-Davis and Company, McKesson and Robbins, and Powers and Weightman. Director Spencer F. Baird appealed to other American firms and individuals to follow suit.

Donations from American firms represented only one side of the collecting strategy, however. Equally important was the international initiative. Connections with other scientific institutions, including the Royal Botanical Gardens of Kew, England, led to a continual exchange of specimens. Other collections were procured by staff in the field or through individual contacts. Significant collections were obtained from India (through the Kurrachee Municipal Library and Museum), Jamaica (through the Public Gardens and Plantations and Government of Jamaica), Japan (through the Department of Education), China (through the Rev. V. F. Partch, who collected and arranged for the donation of more than

seven hundred specimens), and Korea (purchased by staff in the field). Extensive South American collections were transferred from the Department of Agriculture. The goal was a comprehensive collection of materia medica specimens and official pharmacopoeias from around the world. The expressed value of such a collection was not historical but scientific and educational—both to the professional and the layperson.

Donations from Eli Lilly, Merck, Parke-Davis, Powers-Weightman-Rosengarten, Sharp and Dohme, and E. R. Squibb & Sons were prominent in the accession records through the early years. Long lists of official preparations were carefully recorded and cross-referenced to the *U.S. Pharmacopoeia*, the *U.S. Dispensatory*, or the *National Formulary*. By 1910, however, the collections of materia medica specimens from foreign countries disappeared from the pages of the catalog record. The focus of collecting turned from international to American, and from scientific to historical.

Three contemporary health products collected in China; note the repackaging and selling of the British patent medicine Woodward Celebrated Grapewater for infants (on the right).

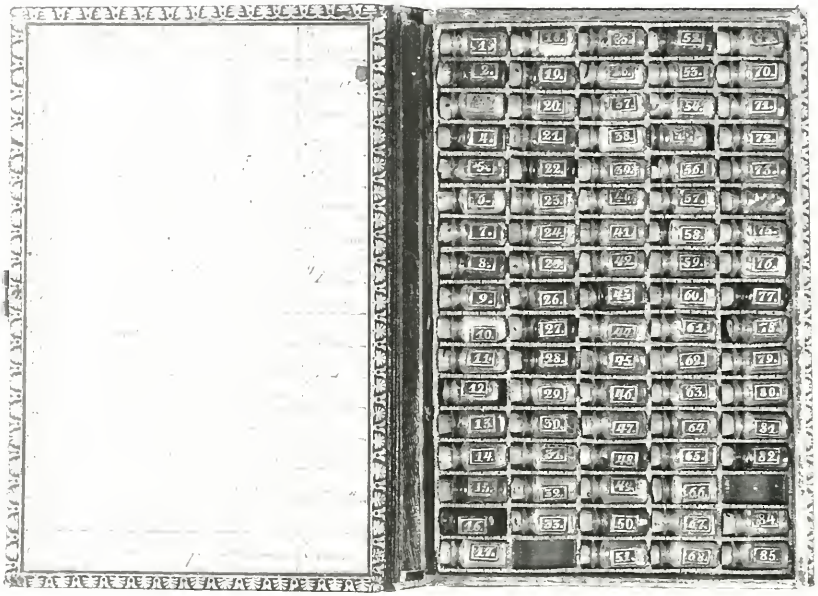
Alternative Measures: Sampling Outside the Medical Mainstream

During the first decades of collections development, there were few deviations from the almost exclusive concern with collecting specimens of "official" materia medica. In 1898, however, curator James Flint began collecting artifacts associated with "magic" or "psychic" medicine, including amulets, talismans, madstones, precious gems, and materials related to voodoo. The collections marked the beginning of a continually reoccurring interest in documenting medical practices outside the mainstream medical establishment.

That interest remains to the present day, even as institutional motivation evolves and the definition of what constitutes alternative therapies changes from one generation to the next. The early collections of magic and psychic medicine, for example, served partly to educate the public about the perils of those ways.

In the 1920s, interest in alternative health measures shifted from other cultures to the most popular alternative American schools, especially homeopathy, osteopathy, and the Eclectic School. Illustrative are the personal artifacts of "The Father of Homeopathy," Samuel Hahnemann, including his medicine case and a vial of Bryonia 400x pellets made from his own personal stock and the remedies of the Boericke and Tafel Homeopathic Pharmacy of Philadelphia, founded in 1835.

The Eclectic School is represented by personal artifacts, notably the laboratory equipment of John King, an analytical pharmacologist at the Eclectic Medical Institute of Cincinnati. A large collection



An interesting specimen from the homeopathic collection, illustrating homeopathy's emphasis on minute doses, this nineteenth-century gold-embossed medicine case contains eighty-five preparations and resembles a book when closed.

of materia medica introduced and employed by other Eclectic physicians was donated by an associate of King's, the Cincinnati chemist John Uri Lloyd, who was the principal manufacturer of eclectic medicines in the nineteenth and early twentieth centuries. Devices and instruments used in osteopathic treatment were also collected, along with some of the personal memorabilia of Andrew Taylor Still, founder of osteopathy, including his Civil War surgical instrument case.

Homeopathic collections, in particular, have continued to grow. The original 1919 collection of Boericke and Tafel material, for example, was exchanged with the manufacturer in 1932 for fresh specimens. The practice of returning deteriorated and discolored specimens to the manufacturer for replacement was common at the time. The "fresh" look of specimens for display was considered important. More modern homeopathic remedies, such as Munyon's and Humphrey's, were added to the collection in the late 1950s and early 1960s, including a complete counter display of Munyon's remedies from Vinson's Pharmacy of Rockville, Maryland.

In the early 1970s, while planning for exhibits to celebrate the American Bicentennial, Smithsonian staff sought to commemorate the look and feel of the 1876 Philadelphia Centennial Exhibition. At 1011 Arch Street, Philadelphia, they found the incredibly well-preserved original Boericke and Tafel display. The homeopathic manufacturer had been one of the major exhibitors at the 1876 fair.

The Victorian-era display, featuring nearly five hundred specimens of homeopathic

Bristol-Myers Squibb Eighteenth-Century European Apothecary

One of the Smithsonian's most enduring stars is the Bristol-Myers Squibb European Apothecary Collection. Unequaled in the United States, the European apothecary has been at the Smithsonian since 1945, when E. R. Squibb & Sons, through the American Pharmaceutical Association, deposited the 1,100-piece collection at the United States National Museum.

The laboratory, or "Faust Study," of the Squibb Ancient Apothecary with distillation apparatus, mortars and pestles, spoons, bowls, measures, and various kinds of drug containers used for compounding remedies.

Jo Mayer (1870–1940), a pharmacist from Wiesbaden, Germany, assembled this diverse collection of artifacts dating from the fifteenth through the nineteenth centuries. Among them are European-crafted ceramic and rare glass pharmaceutical containers; gothic and rococo-style mortars and pestles from The Netherlands, Switzerland, France, and Spain; franchises, pharmacopeias, and formularies; more than eighty paintings and prints, pharmacy scales, distillation equipment, microscopes, and the ever-present stuffed creatures that have come to symbolize the European apothecary. The wooden cabinets and stained-glass windows came from the Münster Apotheke of Freiburg.

The Ancient Apothecary, as the collection came to be called on this side of the Atlantic, was the centerpiece of the E. R. Squibb & Sons Pavilion at the 1933 Chicago World's Fair ("Century of Progress Exposition"). The collection then returned to New York City, where it was installed in a museum created atop the Squibb corporate headquarters. The collection remained there until it was brought to the Smithsonian.

During a 1991 ceremony at the National Museum of American History, the Bristol-Myers Squibb Pharmaceutical Company deeded over this magnificent collection to the Smithsonian.

Judy M. Chelnick

preparations in the original black cylindrical containers, was donated to the Smithsonian and was displayed in the east wing of the Arts and Industries Building. Along with the Centennial Exhibition artifacts, Boericke and Tafel donated a large array of tinctures and tablet triturates and homeopathic manufacturing equipment. A small collection of contemporary products from Boericke and Tafel brings the collection up to date and serves to document today's renewed interest in homeopathic medicine. Boericke and Tafel is now headquartered in Santa Rosa, California, and is part of HomInt, an international federation of homeopathic firms.

Representative selections of products from two other surviving domestic homeopathic manufacturers—Humphrey's Pharmacal of Rutherford, New Jersey, and John Borneman and Sons of Norwood, Pennsylvania—were added in 1980. The homeopathic collections are rounded out by a unique collection of remedies utilized by a mother-daughter team of homeopathic practitioners, Ethel R. Woodmans and physician Winifred Curtis-Stebbins, who practiced in New York State from the early part of this century to the 1980s.

Another manifestation of contemporary interest in alternative medicine is an increased interest in nonwestern medicine. On collecting trips to China in 1988 and 1995, museum staff obtained approximately 250 specimens of modern preparations, which supplement the historic collections of crude drugs. The collections—old and new, divided by more than one hundred years—offer interesting opportunities to compare and contrast both within the nonwestern tradition and with the parallel change in western medicine over the same time period.

A recent collection of macrobiotic foods from Michio Kushi, the foremost proponent and popularizer of macrobiotic diet in America, represents another instance of Americans turning to nonwestern sources and "natural" healing as alternatives to mainstream medicine. It also represents a contemporary example, within our long tradition, of collecting and preserving specimens related to alternative medical theories and therapies.

Collecting Pharmaceutical Equipment

Curator Charles Whitebread began to seek out objects related to the manufacture and dispensing of medicines, materials that would not only supplement the collections of crude drugs but provide information about the practice of pharmacy. The response from manufacturers was substantial.

The Torsion Balance Company, for example, provided not only contemporary counter and prescription balances but also an 1840 model that was discovered in a company storehouse. Professional organizations also responded; the National College of Pharmacy, for example, donated an original O'Donnell suppository machine in 1921.

Within a decade, with the help of several generous companies, the Smithsonian had assembled a formidable collection of laboratory equipment from such industrial suppliers as the Whitall Tatum Company, the Will Corporation, George D. Feidt and Company, John M. Maris Company, and Glasco Products Company. They provided such equipment as beakers, Bunsen burners, funnels, retorts, precipitating jars, evaporating dishes, and percolators. The Feidt donation also included a large number of mortars and pestles, the first significant donation of this kind.

Whitebread did not neglect appealing to individual donors. He believed, as he wrote in a 1931 letter to Herbert Ell, that "all objects were important because of the need . . . to illustrate the history of medicine making, and to compare the methods of the past with those of the present." Through this willingness to court potential donors, the Smithsonian acquired such diverse objects as tablet molds, show globes, glass medicine bottles, ointment jars, suppository molds, and drugstore furnishings.

Tools, machinery, and even work spaces related to the druggist and the pharmaceutical producer were added to the Smithsonian collection. As the century progressed, the acquisition of these materials was pursued on an increasingly vigorous and grand scale. Among the highlights of the pharmaceutical equipment manufacturing collections are Henry Bower's rotary tablet press, made for John Wyeth of Philadelphia about 1888, which revolutionized tablet manufacturing; John Uri Lloyd's combination still-percolator, which extracted plant products that might otherwise be damaged by heat in ordinary distillation; and the rotary die encapsulation machine invented by R. P. Scherer in 1931 for manufacturing gelatin capsules.

The arrival of the E. R. Squibb & Sons collection in 1945 provided the impetus for the enthusiastic collection of drug jars in the late fifties and early sixties. Merck & Company and Bristol Myers & Company donated magnificent assortments of apothecary jars from across the globe and from throughout the centuries. Jars from Greece, Italy, and France were acquired, along with pots and containers from Mesopotamia, Persia, and Egypt. American drug containers were acquired from generous private collectors like Phillip J. McAullife and Robert W. Vinson.

The extraordinary procurement of an entire pharmacy occurred in 1958. Mishel Wagman, a pharmacist, donated the elegant fixtures of Roche Drug Company, a pharmacy that had once occupied the corner of 8th and G Streets in southwest Washington, D.C. The elaborate Victorian fixtures included wood shelving and counters as well as a number of mirrors. Several large purchases were made to stock the drugstore, including materials from the Hollis Apothecary Shop, a recently closed Boston establishment. A typical wood-and-glass display counter from the I. Emery Rank Drugstore in Lancaster, Pennsylvania, finished the drugstore display. Named *The 1890s American Drug Store*, the period room was one of the most popular exhibits in the Hall of Medical Sciences and still stands behind closed doors on the Museum's first floor.

In the early 1960s, a new source of objects became available as pharmaceutical schools, eager to be rid of archaic equipment, made such material available to the Smithsonian. In 1964, the University of Wisconsin donated over 330 authentic materials once used in classrooms and laboratories—stills, rings, sterilizers, and mortars. George Washington University followed suit a year later, giving both laboratory and dispensing artifacts, including animal restraint devices and other equipment and memorabilia. Within the past thirty years, the schools of pharmacy at Michigan's Ferris State College and the University of Minnesota have also made substantial donations.

Collecting Self-Medicating Products, 1930–1970

Patent or proprietary medicines—products that at times may seem as strange as tiger

These over-the-counter remedies from the Museum's extensive collection of patent medicines feature imaginative graphics and substantial amounts of alcohol.

bones or as likely to be effective as charms and voodoo—have much in common with alternative medicines. Like many of the alternative therapies, they not only allowed the patient to circumvent the "regular" doctor but also fulfilled a desire for natural remedies or expressed a simple distrust of mainstream medicine. Together with the products now referred to as over-the-counter (OTC) preparations, they comprise a large part of our pharmacy collections.

The first patent medicines acquired by the Smithsonian were recorded in the catalog book in 1930. Museum staff solicited American distributors for specific products in an effort to collect and exhibit a few of the oldest and most respectable patent medicines—preparations that had "stood the test of time without criticism" and could still be found in American drugstores. The purpose was not, as one distributor was assured by Whitebread, to in any way discredit the product and, in so doing, discredit the donor.

Among the first specimens were Haarlem Oil (or Dutch Drops), invented in 1672 by Claes Tilly, a Dutch medical scholar; Dr. John Hooper's Female Pills, the patent for which was granted by King George II in 1743 to Hooper, "apothecary and man midwife"; and Roche's Herbal Embrocation, patented in 1803 "as external treatment for whooping-cough, croup and colds on the chest."

Among later additions was Porter's Curative Sugar Pills, an early example of sugarcoated medicine. In the late 1950s, several samples of patent medicines containing opium were acquired, including Bateman's Pectoral Drops and Godfrey's Cordial. These illustrate the ubiquity of narcotics in early patent medicines, a class of drugs that by the 1950s had become highly controlled.

In the early 1960s, the patent medicine collection grew from a few handfuls to many hundreds. That growth coincided with plans for a Hall of Pharmaceutical History in the Museum of History and Technology. One of the gems of the exhibit hall was to be the reconstructed *1890s American Drug Store* installation. The need to stock those shelves prompted the acquisition of hundreds of patent remedies, ointments, liniments, powders, cosmetics, and other sundries. Most of the material was purchased in quantity from a few dealers and collectors of pharmaceutical antiques.

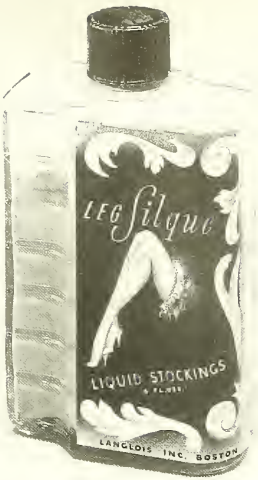
End of an Era: Collecting the Family Drugstore

An unprecedented opportunity to collect the myriad products of the twentieth-century American drugstore occurred in 1978, when the April 30 edition of the *Sunday Charleston News and Courier and*

Evening Post announced: "After an era of grinding pharmaceutical concoctions with mortar and pestle for a grateful clientele, the Aimar brothers closed the tall doors of the King and Vanderhorst streets apothecary forever. It marked the end of a Charleston [South Carolina] landmark, a 126-year-old family business." The contents of the G. W. Aimar Drug Company were offered to the Smithsonian.

Over the next dozen years, as many family-owned drugstores disappeared in favor of the larger chains, the Smithsonian had the opportunity to collect broadly from small pharmacies. Among them were the Tupper Pharmacy of Summerville, South Carolina; the Reid Pharmacy of Clifton, Illinois; Oaklawn Pharmacy, Inc., of Cranston, Rhode Island; Sherman Pharmacy of Sherman, New York; Glaser Pharmacy of Sayre, Pennsylvania; Fournet Drugstore of Saint Martinville, Louisiana; and the Georgetown Pharmacy of Washington, D.C.

Each collection is extensive, ranging from a few hundred to a thousand artifacts each. Some owners had stockpiled unused products over the years; others had continued to display older objects and preparations in order to preserve an old-time atmosphere. There were traditional prescription medicines, as well as vitamins, cosmetics, and sundries, ranging in time from the 1880s to the 1980s. They were particularly strong in post-World War II cosmetics and OTC products. The Glaser Pharmacy and Fournet Drugstore collections alone contain approximately 230 cosmetic products. Among items chosen for exhibition, one of the more popular has been the leg makeup of the World War II era, used when "nylons" were unobtainable. Contemporary specimens of cosmetics and skin care, some of which are showcased in the recent exhibition *About Faces: The Postwar Boom in Craniofacial Knowledge,* attest to the increasingly fine line between cosmetics and health care products. New products tout the health benefits of vitamins and natural herbal ingredients as well as the cancer-preventative benefits of sunscreens.



Leg Silque was among the "liquid stockings" cosmetics available to World War II-era women when nylon hosiery was not.

Collections of vitamins and nutritional products have also come into their own since the 1980s. Prior to the 1980s, such items consisted of little more than samples from Merck & Company donated for a vitamin exhibit in 1956 and a sampling of such popular product supplements as Geritol, Unicaps, One A Day, and Dayalets—all obtained from manufacturers between 1957 and 1958. In the early 1980s, while planning another vitamin exhibit, Smithsonian curators appealed to nine vitamin manufacturers; they responded with more than a hundred contemporary

A lithographic advertisement (c. 1885) from the William Helfand Collection for Warner's Safe Cure, an American patent medicine, promised relief for liver and kidney ailments.

vitamin and nutritional supplements. At the same time, the Glaser and Fournet drugstore collections added breadth to the collections with more than 110 vitamin products from the 1930s through 1970s.

Diffusing Knowledge

Over the past century, the Smithsonian has acquired a tremendous range of items related to the manufacturing and dispensing of drugs. But it is not enough to collect. It is equally important to document the collections and make them accessible. Procuring business and archival records, conducting interviews, and filming manufacturers and providers have all become an integral part of modern collecting.

The Boericke and Tafel collection, for instance, was accompanied by correspondence, records, photographs, and memorabilia. Furthermore, the charming and effusive Gustav Tafel consented to an interview, which was filmed as he conducted a tour of his facility. The footage was edited into a Smithsonian documentary that aired as part of the "Reunions: Memories of an American Experience" series.

Similarly, when Garfield & Company, a manufacturer of Seidlitz powders, ended its operations in 1980, it gave the Smithsonian a vast array of materials: product samples, blueprints, catalogs, business records, promotional devices, and some of the intricate machines that had packaged the powders since 1912. The machines were filmed in operation, and Julius Garfield himself agreed to be interviewed.

In 1982, Parke-Davis and Company, a consistently generous donor, gave an important archival collection of laboratory and research notebooks dating from 1902 to 1946. The Norwich Eaton Pharmaceutical Company donation of OTC medications was accompanied by photographs, trade catalogs, price lists, and boxes of manufacturing records. These materials offer invaluable insights into the manufacturing and business practices of the pharmaceutical industry.

Advertising literature is another important source of information about pharmacists and the practice of pharmacy. William Helfand, one of the premier collectors of medical and pharmaceutical ephemera, has donated to the Smithsonian more than one thousand assorted catalogs, labels, almanacs, postcards, trade cards, blotters, and even cartoons related to medical topics. Richard H. Bogard of Peoria, Illinois, has shared his collection of trade cards, toys, and grooming devices that advertise pharmaceutical companies.

The rich pharmacy collections will continue to grow and expand as staff continue to collect and document the ever-changing pharmaceutical profession and industry.

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Scientific Medicines

Ramunas Kondratas

The production of vaccines and sera in the latter half of the nineteenth century marks the start of what might be called the Era of Scientific Medicines. The development of these substances is based on a belief in a specific etiology of disease—bacterial, viral, or genetic—and on the use of sterile and safety-testing techniques, standardization of product strength, advanced laboratory and refrigeration equipment, and sanitary manufacturing facilities. Medicines produced in this way have also been called "ethical" because they stand in contrast to the dubious conditions under which many earlier over-the-counter nostrums and cure-alls were produced and marketed.

The Earliest Biologics

The Smithsonian has a strong international collection of vaccines, sera, hormones, and antibiotics. A treasure is a small bottle of tuberculin, probably from the Charité Hospital in Berlin. Labeled *Tuberculinum kochi*, it is dated 1891 and signed by Libbartz, a colleague of Robert Koch's, who announced its discovery in 1890.

Smallpox vaccine, of course, was the first biological. Although Edward Jenner showed in 1796 that using lymph from a patient with relatively benign disease of cowpox could provide immunity from smallpox, it was another century before his discovery would usher in scientific medicine.

The biologics industry was launched by the realization that immunizing lymph could be extracted from inoculated calves.

A small vial of Tuberculinum kochi, *dated 1891; tuberculin, at first, was touted as a miracle cure for tuberculosis but experience showed it was a reliable diagnostic tool, not a cure.*

The H. K. Mulford Company of Pennsylvania, one of the pioneers in the field, began production of biologicals in 1894. In 1898 it introduced both a glycerinated vaccine lymph in capillary "tube-points"

Three bottles of the first polio vaccine developed by Jonas E. Salk and injected into humans. Photograph by A. Russetti.

and the scarifiers required to administer it. Mulford was also one of the first U.S. companies to produce diphtheria and tetanus antitoxins, rabies vaccine, and a host of so-called bacterins and serobacterins (killed bacteria designed to produce active immunity by stimulating the formation of specific antibodies following injection). The Smithsonian has a fine selection of most of the Mulford products, together with accompanying trade literature and scientific publications.

Another historic treasure is a bottle of diphtheria antitoxin produced by the Hygienic Laboratory (precursor of the National Institutes of Health). Dated May 8, 1895, it is the oldest known sample in the United States. The earliest commercial diphtheria antitoxin products packaged and sold in the United States by Parke-Davis and Company are also represented in the Smithsonian collection. Parke-Davis was the first manufacturer to receive a government license to produce biologics in the United States under the Biologics Control Act of 1902.

Twentieth-Century Advances

Two major discoveries in the 1920s—insulin, at the University of Toronto in 1921–1922 and penicillin, in England in 1928—added significantly to the growing armamentarium of scientific medicines. The Smithsonian has been at the forefront in recognizing and preserving those milestones. In 1930, curator Charles Whitebread organized the exhibit *The Story of Insulin*, for which he obtained many early products and related materials from the Eli Lilly Company, first commercial manufacturer of insulin. In later years the Museum acquired flasks and other objects from several sources documenting the wartime production of penicillin in the United States. And in 1953, Sir Alexander Fleming, the discoverer of penicillin, donated one specimen of the mold *Penicillium notatum*, from which penicillin was originally made.

The story of antibiotics, which began with penicillin, continued with the work of Selman A. Waksman, Albert Schatz, and others at Rutgers University. Their research resulted in the discovery of the second major antibiotic, streptomycin, in 1943. Streptomycin was the first antibiotic effective against tuberculosis.

Among objects donated to the Smithsonian from Waksman's laboratory and office are a shaking machine used for screening various antibiotics, copies of four notebook pages that describe four crucial experiments establishing the nature and effectiveness of streptomycin, a sample

of streptomycin that was submitted to the Food and Drug Administration, and an inoculating needle used to isolate and transfer the first strains of *Streptomyces griseus* that produced streptomycin. The Smithsonian also acquired from Schatz a sample of the fungus *Streptomyces griseus,* dated October 19, 1943. A batch of that material was sent to the Mayo Clinic in Rochester, Minnesota, for the first animal trials.

The early work in antibiotics is rounded out by donations of such materials as tetracycline from the pharmaceutical manufacturer Charles Pfizer and Company, whose researchers helped isolate and produce it, and some Petri dishes used by botanist Benjamin M. Daggar who, while working for Lederle Laboratories, developed aureomycin in 1948.

From Artificial Respiration to Vaccine

The story of poliomyelitis can be told in several ways. One is through the efforts of patients and physicians to deal with the disease before its etiology was well established and a vaccine developed. That, primarily, is the story of the iron lung. Because severely paralyzed patients had great difficulty breathing on their own, researchers first directed their efforts toward developing means of artificial respiration. Philip Drinker of the Harvard School of Public Health helped develop the so-called Drinker respirator in 1929, which prolonged administration of artificial respiration for adults and children. The device was promptly dubbed the "iron lung."

The Smithsonian is fortunate to have not only one of Drinker's models but also an improved and simplified design by John Haven Emerson, who donated one of his machines in 1941. The most recent acquisition is the iron lung used by disabilities activist, founder of the first independent living center, and creator of the World Institute on Disability, Edward V. Roberts (1939–1995), who contracted polio as a teenager and had to remain on a respirator for the rest of his life.

Another way to tell the story is by documenting the research into the viral etiology of poliomyelitis and the eventual development of a vaccine. Thanks to a very generous donation by the National Foundation for Infantile Paralysis (NFIP) in 1958, the Smithsonian has a wealth of such resources: flasks used by John F. Enders at the Harvard School of Medicine showing the growth of polioviruses in cultures of human embryonic skin and muscle tissues as well as a drum used by him for rolling test tubes containing tissue cultures; the first page of Jonas E. Salk's application to the NFIP for a grant to develop a polio vaccine; a syringe and three bottles of the first vaccines given by Salk to humans; twelve vials of the 1954 NFIP field trial vaccine; an NFIP record card of Randall Kerr, the first child vaccinated; and an IBM punchcard used during the trials to record essential information about each child vaccinated.

And the donations relating to this momentous discovery continue. In November, 1997, the Smithsonian received twelve original photographs of polio growing in cells, a gift from Frederick C. Robbins, who together with Enders and Thomas H. Weller won a Nobel Prize in 1954 for their work on polio. Samples of the attenuated Sabin-type oral poliovirus vaccines round out the collection. As member nations of the World Health Organization mount an international campaign to eradicate polio—as they did with smallpox—the Smithsonian will be

An array of smallpox-related artifacts: (clockwise from lower left) a steel bifurcated vaccinating needle; an early nineteenth-century, silver scab-carrying case; two scarificators; a package of glycerinated vaccine lymph in capillary "tubepoints"; and, vaccination shields. Photograph by A. Russetti.

there to document the achievement and preserve it for future generations.

The development of scientific medicines has increased markedly since the 1950s. However exciting the possibility, collecting comprehensively is a most difficult challenge. To date, the Institution has focused attention on the development of chemotherapeutic agents, AIDS-related drugs, and the new class of genetically-engineered medicines.

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Sopona and the Bifurcated Needle

On December 9, 1979, the World Health Organization (WHO) announced the single greatest achievement in medical history—the global eradication of smallpox—medicine's only total victory over a human disease. The story began in 1966, when the world's smallpox incidence was about fifteen million new cases annually, of which some two million died. Donald A. Henderson, assigned from the Centers for Disease Control to head the WHO campaign, had to face the fact that no human disease had ever been completely eliminated, that most authorities thought the task impossible, and that there was no basis for either a time plan or budget. Further, besides the medical circumstances, Cold War politics militated against international cooperation for even the greatest humanitarian goals.

Since smallpox spread only one way, person to person, and those who contracted the virus either died or developed lifelong immunity, WHO field workers targeted every district where outbreaks existed for vaccination campaigns. That plan turned huge areas into virtual islands, which the vaccinators then could narrow down further, finally to individuals. Incredibly, in only six years, the campaign succeeded in ridding smallpox from the Americas. By 1975, Asia was clear, and on October 26, 1977, the last case was found in Africa. In all, smallpox eradication took ten years and nine months, at a cost of about $100 million. This colossal achievement brings to mind Churchill's remark, though on a much greater scale, that "never has so much been owed by so many to so few."

Among the Smithsonian's large collection of objects illustrating the smallpox eradication story, one of the most culturally interesting is a statue of the smallpox god Sopona, who symbolized a warrior, hunter, musician, and philosopher to the west African Yoruba people. More strictly medical items include a jet vaccinator, an assortment of public health signs and posters, a box of Dryvax (freeze-dried *vaccinia* vaccine from 1963), and a variolator's mortar, pestle, and scab carrier.

A figurine of Sopona, god of smallpox to West African Yoruba people.

Of special significance in this history of medicine is a small dispenser of bifurcated vaccination needles. Invented by Benjamin A. Rubin in 1968 and manufactured by Wyeth Laboratories in Philadelphia, the bifurcated needle proved to be essential to the eradication of smallpox. When the forked end of the needle was dipped into the vaccine, one drop (enough for a single vaccination) was caught between the prongs. The vaccinator would then rapidly prick the skin with the needle about fifteen times. Because Rubin's bifurcated needle used only a quarter as much vaccine as older models, its use, in effect, quadrupled the vaccine supply. Vaccinators could be trained in minutes, and the needles could be sterilized and reused. A single field worker could carry out as many as fifteen hundred vaccinations in a day. Considering what this tiny, simple device accomplished, the bifurcated needle certainly ranks among the most important medical implements of all time.

G. Terry Sharrer

The dress uniform of Surgeon-General Hugh S. Cumming is featured in this exhibition commemorating the centennial of the National Institutes of Health. At left foreground is a surgical set belonging to John Maynard Woodworth, first Surgeon-General of the U.S. Public Health Service; at right foreground is a Jarvik-7 heart pump.

Public Health Collections

Patricia Peck Gossel

Public health can be interpreted very broadly. The Smithsonian collections encompass all sorts of artifacts that provided for the public's health. Smallpox vaccine and more recent vaccines and biologicals—all well represented in our pharmacy collections—have been used to protect people from contagious diseases since the colonial period. Our engineering collections have a rich store of artifacts, blueprints, and archives documenting the introduction of municipal water and sewage treatment. Here, I will focus on two sets of disparate artifacts: U.S. Public Health Service (USPHS) items and contraceptive items.

Few aspects of rural or urban life in the United States have not been touched by federal public health services. But the roots of that activity can actually be found in public funding for health care services for merchant seamen.

Early Public Health History

For most of the nineteenth century, the Marine Hospital Service was a motley combination of hospitals built with government funds and contract services managed by customs collectors and politicians. In 1869, Treasury Secretary George S. Boutwell commissioned John Shaw Billings to inspect the marine hospitals. Billings, who had made his reputation in public health by overseeing the construction of hospitals for the Union Army during the Civil War, reported that of the original thirty-one hospitals only nine still functioned.

John Maynard Woodworth was appointed the first Supervising Surgeon of the Marine Hospital Service in April 1871. Using a military model, Woodworth made the Marine Hospital Service a broad and efficient public health provider. In 1887, the Marine Hospital Service opened a Hygienic Laboratory (for enforcing quarantines) on Staten Island under the direction of John J. Kinyoun. It is considered the first federal public health laboratory and is the precursor of today's National Institutes of Health.

The Smithsonian holds a small but very important group of artifacts related to the early Marine Hospital Service. Some were on display at Ellis Island in 1996. The collection includes Woodworth's surgical instrument case, a Zeiss microscope said to have been used by Kinyoun, several reagent bottles, a ship's bell used on quarantine vessels in the 1890s, and the yellow cloth quarantine flag flown from quarantine launches in the same period.

The highlight of the Marine Hospital Service artifacts is a sample of diphtheria antitoxin made at the Hygienic Laboratory on March 8, 1895. Kinyoun had learned to make diphtheria antitoxin from Emil Roux at the Pasteur Institute in 1894. The Smithsonian's holding may be the oldest extant sample of diphtheria antitoxin manufactured in the United States.

A model of the Coast Guard cutter *U.S.S. Bear* is another USPHS donation. The *U.S.S. Bear,* served by a long series of USPHS officers, was known for its Arctic voyages. In 1932 it was refitted for the

Antarctic expedition led by Rear Admiral Richard E. Byrd. It was retired in 1944.

Public Health Uniforms

Uniforms associated with various aspects of public health are well represented in the collections. In 1926, the Museum acquired the full-dress uniform and cape worn by William C. Gorgas, who became Surgeon General of the U.S. Army in 1914. Gorgas directed sanitary campaigns against the yellow fever mosquito—first in Havana and later in the Canal Zone—and is credited with the health reforms that enabled completion of the Panama Canal.

Uniforms for several ranks of USPHS officers are in the collection. Among the more contemporary are a 1970s-era woman's dress white USPHS uniform, the dress uniform of Surgeon General C. Everett Koop (who spurred the Reagan administration to support research on AIDS), and that of his Deputy Surgeon General, Faye G. Abdellah, a pioneer in nursing research.

Other artifacts include:

The uniform worn in 1905 by Joseph H. White, who that year, in New Orleans, had directed what would be the last campaign against epidemic yellow fever in the continental United States;

A World War I captain's uniform that belonged to Hugh S. Cumming, who served as Surgeon General from 1920 to 1936 under five Presidents (Woodrow Wilson, Warren Harding, Calvin Coolidge, Herbert Hoover, and Franklin D. Roosevelt);

The 1914 dress uniform of an assistant surgeon in the Public Health Service worn by Louis Laval Williams, a specialist in malaria control who was a U.S. delegate to the 1946 International Health Conference in New York at which the World Health Organization was created;

The summer and winter cadet nurses uniforms worn during World War II by a member of the Army Nurse Corps while she was in a special USPHS-sponsored training program at Mercy Hospital, Denver.

A particularly interesting uniform is one worn by Mary Breckinridge, who founded the Frontier Nursing Service in rural Kentucky in 1925. Her twenty trained nurses roamed the rural Kentucky hill country on horseback, providing health care and delivering babies. A pair of midwifery saddlebags used by a frontier nurse is on display in an exhibit on woman's suffrage called *Parlor to Politics*. These public health uniforms are part of a larger collection that includes medical corps and Red Cross uniforms from World Wars I and II, nurses' uniforms, lab coats, and surgical clothing.

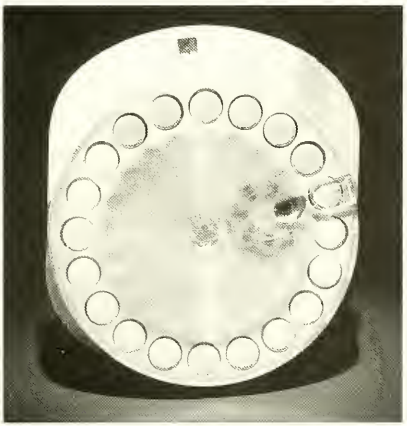
Contraception

Contraception, once a very private matter, became part of U.S. federal public health policy in the late 1960s and became an urgent issue of disease control with the identification of AIDS in the 1980s. Federally-funded public health services expanded to include the distribution of birth control devices domestically as well as abroad. The Office of Population of the U.S. Agency for International Development has become the world's largest purchaser of contraceptive devices as family planning gained credibility both as a way to slow world population growth and as a way to improve the health of women and children in developing countries.

The National Museum of American History has developed an important and diverse collection of contraceptives, international in scope, since the 1980s. It

Julius Schmid, Inc. began making natural rubber condoms around 1920. Their Sheik brand condoms dominated the market in the western United States and in Canada in the 1930s.

contains more than three hundred contraceptives, including pessaries, diaphragms, condoms, creams, foams, oral contraceptives, intrauterine devices, and feminine hygiene products. The largest donations came from the Margaret Sanger Center in New York City, the Fournet Drugstore in Baton Rouge, and Lester D. Johnson, a Fairfax, Virginia, gynecologist. Among the more unusual acquisitions are condom vending machines and decals from vender Nolan Panisiak, who calls himself "Mr. Condom." Since the Division has begun to focus more effort on documenting the history of AIDS, materials such as condoms and AIDS prevention pamphlets and posters have been added.



Ortho-novum SQ oral contraceptive in a Dialpak™. The container includes a window that shows the day of the week to remind a woman if she had taken her pill.

The scope of the contraceptive collec-

tion was significantly enriched with research for a case study on the birth control pill, which became part of the 1994 *Science in American Life* exhibition. The Worcester Foundation for Experimental Biology donated the laboratory equipment used by Gregory Pincus and Min Chu Chang during their original physiological research into what became known worldwide as the Pill. That donation includes a vial of progesterone in gelatin capsules used in clinical trials in Puerto Rico and rare samples of progesterones sent by pharmaceutical companies to the laboratory in the 1950s for testing of contraceptive properties.

Recently, the Museum acquired the design prototypes for the packaging of the oral contraceptive. The dial pack is considered the first such container designed to help a person remember when to take a prescription drug. A large supplementary collection of contraceptive-related ephemera and trade literature, including files kept by Syntex Corporation of their competitors' advertisements, has made this collection very popular with historians.

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This pre-AIDS-era vending machine promoted condoms for protection against venereal diseases.

Laboratory Apparatus

Patricia Peck Gossel

Since the 1980s, there has been a concerted effort to document the tools and instruments used in medical research and diagnostic laboratories. Four Smithsonian collections—medicine, chemistry, physical sciences, and biology—contain apparatus relevant to the medical laboratory. The chemistry and biology collections, for example, contain large and comprehensive collections of balances, centrifuges, spectrophotometers, pH meters, and chromatography and electrophoresis apparatus.

Stanley Cohen's "scribble book" records his 1973 cloning experiment, which helped mark the beginnings of recombinant DNA technology and genetic engineering. The notebook, timer, test tubes, flasks, and pipette cases are part of the apparatus collected from his laboratory for the 1987 exhibition The Search for Life: Genetic Technologies in the 20th Century.

Microscopes

Although the Museum's collection of several hundred American and European microscopes dates back to the early eighteenth century, special priority is given to American microscopes or those with strong American associations. One of the earliest microscopes made by the Spencer Lens Company of Buffalo, New York, was added to the collection in 1990. It is a Pritchard-style, single pillar with a tripod base, made by Charles A. Spencer between 1849 and 1859. His high-quality objective lenses placed American instruments on an equal footing with European microscopes and marked a turning point for American microscope manufacturing.

A large collection of nineteenth-century books on microscopy was donated by Oscar W. Richards, resident biologist for the Spencer Lens Company (later American Optical Company) in the 1930s and 1940s. His correspondence and reference files held in the Museum's Archives Center document many facets of microscopy.

Bacteriology and Molecular Biology

A circa-1900 bacteriology laboratory was re-created as a museum exhibit with forty pieces of turn-of-the-century bacteriology apparatus from the laboratory of Frederick G. Novy, a University of Michigan bacteriologist known for his work on syphilis and trypanosomiasis. Current collecting efforts are being directed at building a collection of the apparatus used for molecular

Barbara McClintock won the Nobel Prize in 1983 for her discovery of moveable genes in Indian Corn. This work was depicted in the 1987 Search for Life *exhibit (left). The ears of corn and the Bausch & Lomb dissecting microscope (above) were collected from her laboratory at Cold Spring Harbor in 1993.*

biology and the study of DNA. The goal is to document the evolution of the principal instruments used to separate and analyze biological molecules. Among existing highlights are one of Theodore Svedberg's centrifuge rotors, a Model E Ultra-Centrifuge (serial number 3), the Spinco Model H electrophoresis instrument, and a prototype LKB 9000, which was the first combined gas chromatograph and mass spectrometer that could be used to analyze the chemical structure of biological molecules.

Collecting the Technology of Tomorrow

Smithsonian curators pay close attention to the development of new instrumentation so that prototype instruments can be collected. Since the doctors, scientists, and engineers who built the prototypes are still working and the instruments are still being made, interviews and videohistories can be used to document an instrument's conception, design, manufacture, and use. Another big advantage is that commercial instruments can be obtained in like-new condition, and trade literature and operation manuals are easily acquired.

Two examples of important mid-1980s technologies acquired by Smithsonian curators through this approach are three prototypes of the "gene gun" (a DNA transfer system that shoots DNA-coated pellets into host cells) and two prototype thermal cyclers used in the polymerase chain reaction (PCR) technique that multiplies strands of DNA. Ray Kondratas filmed the manufacture of the thermal cycler and conducted lengthy videotaped interviews with Kary B. Mullis, who received the 1993 Nobel Prize in

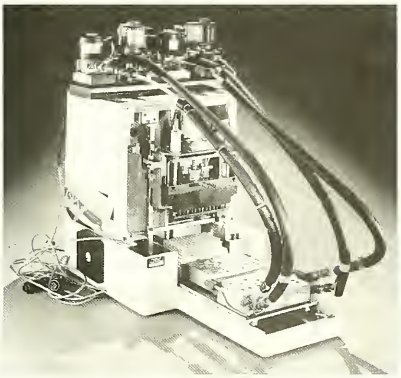
Chemistry for developing the PCR technique.

Commemorating Pioneering Chemists and Their Laboratories

Several Smithsonian collections preserve the full array of apparatus and instrumentation used by a single scientist. Illustrative are the laboratory bench, cupboards, and apparatus used at Stanford University by Stanley Cohen, who, with Herbert Boyer, developed the recombinant-DNA procedure and started the biotechnology revolution. That equipment was collected for *The Search for Life: Genetic Technologies in the 20th Century* exhibition in 1987 and is now featured in *Science in American Life*. The hood, microscope, glassware, and shakers used by Min Chu Chang during his pioneering physiology studies of *in vitro* fertilization are in the biological sciences collection, as is a collection of laboratory and field apparatus that Barbara McClintock used in the corn genetics research that resulted in the 1983 Nobel Prize in Physiology or Medicine.

Instruments crucial to the medical diagnostic laboratory are also being documented. The medical sciences collection has the prototype and first commercial version of the Technicon AutoAnalyzer, built in 1957. It was the first apparatus to automate the analysis of blood chemistry, thereby inaugurating the drive to automate the clinical diagnostic laboratory. Equally significant is the workhorse of the hematology laboratory since the 1960s, an early Coulter Counter, which electronically counts red and white blood cells and platelets.

Historians of science are finding that laboratory practice profoundly influences the development of scientific ideas. The Museum's scientific instrument collections document many of these changes. As medical diagnosis has moved into the laboratory, instruments once confined to research have become commonplace in the hospital. For example, such research techniques as PCR have revolutionized the identification of pathogens by bringing the power of recombinant DNA science into the diagnostic laboratory. By collecting prototype instruments for these new techniques and fully documenting their design and manufacture, museum collections can provide powerful new sources of information about the transition from scientific research to medical practice.



"Mr. Cycle" is the prototype of the PCR thermal cycler. It automatically pipettes an enzyme into test tubes of DNA, and heats and cools it to induce the DNA to copy itself in the polymerase chain reaction (PCR). "Mr. Cycle" was built in 1985 for Kary Mullis, who won the Nobel Prize in 1993 for discovering PCR, the technique which allows researchers to amplify quickly and automatically small amounts of DNA into quantities sufficient for a variety of genetic work, including DNA fingerprinting and genome mapping.

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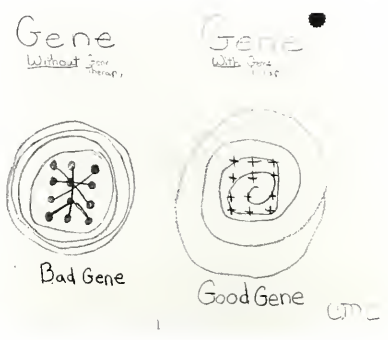
Molecular Medicine: Collecting a Revolution in Progress

G. Terry Sharrer

On September 14, 1990, physicians at the National Institutes of Health carried out the first authorized gene therapy clinical trial on a four-year-old girl, Ashanthi V. DeSilva, who suffered from a rare monogenic disorder—Severe Combined Immune Deficiency (SCID), more popularly known as "Bubble Boy disease." Four months later, a second SCID child, Cindy M. Cutshall, was treated.

With repeated infusions of their own genetically-corrected cells over the next several years, both patients enjoyed improved health. Even while those treatments were in progress, protocols for such hereditary diseases as acquired immune deficiency, autoimmune diseases, and cancer won approval for clinical trials. By late 1997, a total of 204 human gene transfer experiments had been authorized, enrolling about two thousand patients.

Gene therapy and *molecular medicine* are not synonymous terms, but the original gene therapy clinical trial in 1990 was a culmination of several historical concepts on which molecular medicine is based—"molecular disease," "inborn errors of metabolism," "one gene–one enzyme," "the double helix," "recombinant DNA," "genome mapping," and "transgenic vectors." Scientifically, molecular medicine integrates the disciplines of cell biology and regulation, genetics, immunology, structural biology, and neuroscience. Of course, each field is enormous in itself; a quick Internet search under the term "Molecular Medicine" would yield nearly a million documents.



Cindy M. Cutshall, who was successfully treated with gene therapy, drew this picture of her condition and presented it to the Smithsonian.

The Museum's molecular medicine collection is composed of three categories: the basic sciences, genetic technologies, and clinical applications.

The Basic Sciences

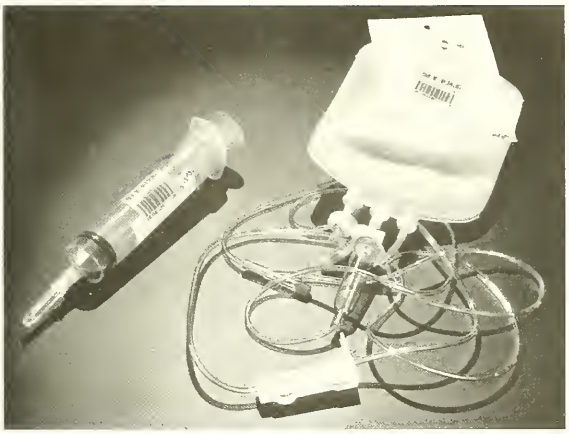
The first major collecting initiative came in 1987, when the exhibition *The Search for Life: Genetic Technologies in the 20th Century* opened. Especially notable among the accessions were several brass base pair templates from James Watson's and Francis Crick's original DNA model. As Watson wrote in *The Double Helix:* "Only a little encouragement was needed to get the final soldering accomplished in the next

couple of hours. The brightly shining metal plates were then immediately used to make a model in which for the first time all the DNA components were present."[1]

A key clue for matching the correct forms of adenine and thymine or guanine and cytosine came from American crystallographer Jerry Donohue, who worked in the same laboratory as Watson and Crick. After the double helix research was published in *Nature*,[2] Donohue kept the model templates as souvenirs. Later, he returned to the United States and took a position at the Fox Chase Comprehensive Cancer Center in Philadelphia. Shortly before his death, Donohue gave the templates to his friend and fellow crystallographer Helen Berman, who presented them to the Smithsonian in 1988.

Other highlights of the basic sciences group are a counter-current distributor identical to the one Robert W. Holley used in isolating the first transfer RNA in 1961 (donated by the Colorado School of Mines); a centrifuge from Marshall W. Nirenberg's work in deciphering the genetic code (a gift of the National Institutes of Health); and the first fluorescence-activated cell sorter, developed in 1973 and used in numerous studies for analyzing, sorting, and cloning cells (donated in 1988 by the Genetics Department of Stanford University, through Leonard Herzenberg).

Recently, the automated amino acid analyzer built by Stanford Moore and William H. Stein at Rockefeller University in 1958 in order to determine the primary structure of ribonuclease was added to the collection. The Moore-Stein analyzer complements another innovation developed at Rockefeller University—Bruce Merrifield's peptide sequencer, which he donated to the Smithsonian in 1987.



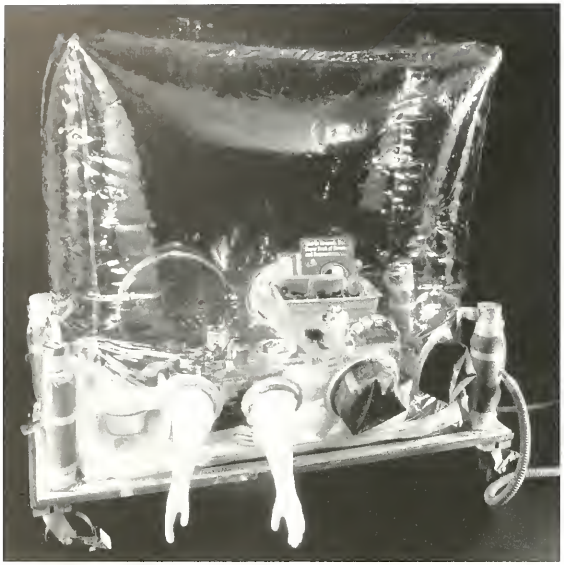
Infusion bag from the first gene therapy clinical trial, September 14, 1990, and syringe from the first bone marrow stem cell gene therapy trial, May 3, 1993.

Holley, Nirenberg, Moore, Stein, and Merrifield all won Nobel Prizes for their accomplishments.

Genetic Technologies

The genetic technologies collections have also benefitted from the outstanding generosity of leading scientists. Stanley N. Cohen contributed not only most of the original equipment used in his recombinant DNA research at his Stanford University laboratory but also the patent certificate (dated December 2, 1980) issued to him and Herbert Boyer at the University of California at San Francisco, for their "molecular chimeras" process. In one laboratory notebook, Cohen first describes his ideas for cutting and recombining DNA fragments, titled "Outline for Recombination Paper."

Perhaps the most important technical development in molecular genetics after recombinant DNA was the polymerase



One of several isolation units built for David Vetter (1971–1984), the so-called "Boy in the Bubble."

chain reaction (PCR) that Cetus Corporation biochemist Kary B. Mullis introduced in 1985. The PCR technique has allowed researchers to amplify quickly and automatically small amounts of DNA into quantities sufficient for a variety of genetic work, including genome mapping. "Mr. Cycle" and "Son of Son of Cycle" are two PCR prototypes developed by the Cetus Corporation and donated to the Smithsonian in 1993.

Of unique interest is a homemade PCR robot built by Kenneth Kinzler in the Laboratory of Molecular Genetics at the Johns Hopkins Oncology Center. Kinzler used his robot in the discovery of the so-called p53 gene—a DNA fragment implicated in more than half of all human cancers.

Clinical Applications

Perhaps the two best known stories represented in the group of clinical applications are those of David Vetter (1971–1984), the "Bubble Boy," and the first gene therapy clinical trial.

In 1986, the Museum acquired a mobile support vehicle, spacesuit, bubble-shaped isolation units, medical literature, and personal memorabilia documenting David's struggle against SCID, a condition that left his body defenseless against disease and confined him to a sterile, plastic, bubble-like environment for nearly all of his life. David died on February 22, 1984, following an unsuccessful bone marrow transplant, an attempt to provide his body with the capacity to make its own antibodies and thus free him from the bubble.

Both the mobile support vehicle and spacesuit were developed by the National Aeronautics and Space Administration; they were transferred from the Lyndon B. Johnson Space Center in Houston, Texas. William Shearer, David's physician, arranged for donation of the isolation units from Texas Children's Hospital and Baylor College of Medicine in Houston. David's parents gave such personal objects as games, toys, and drawings—all of which document David's lively personality as well as his life in the bubble. The "Bubble Boy" may well have been the most famous patient in history.

Michael Blaese, Kenneth Culver, and W. French Anderson contributed several objects from the first gene therapy experiment—notably, the infusion bag that contained Ashanthi's corrected lymphocytes and the syringe used to inject them.

Drawings by Ashanthi and Cindy depicting their experiences as patients complement the collection.

In 1996, Curt Civin, at the Johns Hopkins Medical Center, presented the prototype instrument that he and Alan Hardwick of the Baxter Healthcare Corporation developed to separate bone marrow stem cells from peripheral blood. In June, 1997, Civin and colleagues at Johns Hopkins used the Baxter isolator for a stem cell harvest and then carried out a bone marrow transplant *in utero*, which is expected to cure metachromatic leukodystrophy before the child is born.

A more extensive listing of Smithsonian objects relating to molecular medicine would include some fifty specimens of cell culture glassware from Wilton Earl's NIH laboratory, where he pioneered the techniques of growing human cells in the 1950s; a large fermentation tank manufactured by Genentech, Inc. that produced human insulin from transgenic bacteria; various laboratory instruments (RCA electron microscope, Beckman pH meter, Beckman spectrophotometer, and microbalance); John Sanford's "gene gun," a biolistic device used to "shoot" foreign DNA into cells; and numerous pharmaceuticals—from Mustargen and other anticancer drugs to Humulin and recombinant Interferon Alpha.

In process for acquisition are several leukopheresis machines as well as objects that illustrate combinatorial chemistry and high-throughput screening. In many instances, the accession files are replete with operating manuals, drawings, photographs, and video interviews.

In spite of a gestation that arguably reaches back to the mid-nineteenth century, molecular medicine is truly a revolution comparable to the introduction of germ theory. Just as germ theory changed concepts of illness and ultimately made health a more achievable goal, molecular medicine holds the promise of treating diseases at or near their points of origin rather than at the distant manifestation of symptoms. And since health influences all other hopes and achievements, molecular medicine is indeed a fruitful field for museum collecting.

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Notes

1. James D. Watson, *The Double Helix: A Personal Account of the Discovery of the Structure of DNA.* Norton Critical Edition, Gunther S. Stent, ed. (New York: W. W. Norton, 1980), 117. Reference is given to the Norton Critical Edition because the volume is a rich source of additional material.

2. J. D. Watson and F. H. C. Crick, "A Structure for Deoxyribose Nucleic Acid," *Nature* (April 25, 1953): 737-38.

View of the stacks in The Dibner Library of the History of Science and Technology on the first floor of the National Museum of American History. This rare book library was established in 1976 with a generous gift from inventor, entrepreneur, and collector Dr. Bern Dibner and includes major holdings of rare materials in science, technology, medicine, natural history, and anthropology, dating from the 15th to the 20th centuries.

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